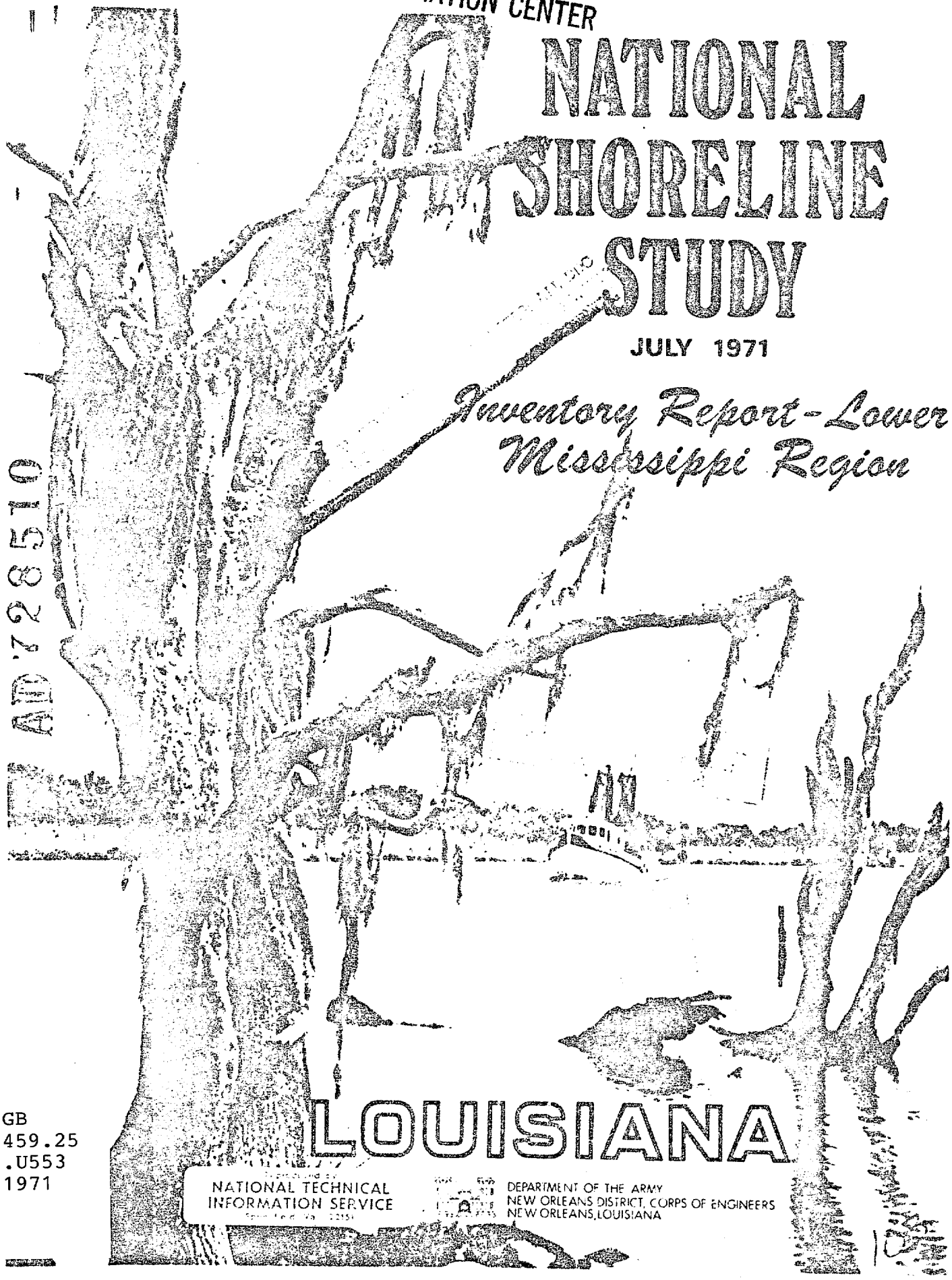
NATIONAL SHORELINE STUDY

JULY 1971

Inventory Report - Lower Mississippi Region



LOUISIANA

NATIONAL TECHNICAL
INFORMATION SERVICE

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

The National Shoreline Study

How will the shore be used ?

SEE

SHORE MANAGEMENT GUIDELINES

What is its condition ?

SEE

REGIONAL INVENTORY REPORTS

What can be done ?

to preserve or enhance the shore, by using—

- Engineering techniques

SEE

SHORE PROTECTION GUIDELINES
REGIONAL INVENTORY REPORTS

- Management techniques

SEE

SHORE MANAGEMENT GUIDELINES

NATIONAL SHORELINE STUDY

In 1968, the 90th Congress authorized this National appraisal of shore erosion and shore protection needs. This National Shoreline Study and the existing Federal shore protection programs recognize beach and shore erosion as problems for all levels of government and all citizens. To satisfy the purposes of the authorizing legislation, a family of 12 related reports has been published. All are available to concerned individuals and organizations in and out of government.

REGIONAL INVENTORY REPORTS (one for each of the nine major drainage areas) assess the nature and extent of erosion; develop conceptual plans for needed shore protection; develop general order-of-magnitude estimates of cost for the selected shore protection; and identify shore owners.

SHORE PROTECTION GUIDELINES describe typical erosion control measures and present examples of shore protection facilities, and present criteria for planning shore protection programs.

SHORE MANAGEMENT GUIDELINES provide information to assist decision makers to develop and implement shore management programs.

REPORT ON THE NATIONAL SHORELINE STUDY, addressed to the Congress, summarizes the findings of the study and recommends priorities among serious problem areas for action to stop erosion.

Cover Photograph
courtesy of Louisiana Wild Life & Fisheries Commission

SUMMARY

This report is one of the nine regional inventory reports which are a part of the study and appraisal of the national shoreline authorized by Section 106 of Public Law 90-483, approved 13 August 1968.

It is a compilation of available information on the gulf coast, including bays and estuaries, of the State of Louisiana. Included in this regional inventory report is very general information on the physical characteristics, nature and extent of erosion, identification of problem areas and possible remedial action, ownership, and present and future use of the shore.

NATIONAL SHORELINE STUDY
INVENTORY REPORT—LOWER MISSISSIPPI REGION
LOUISIANA

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Section I
INTRODUCTION

AUTHORITY

This report is a part of the study and appraisal of the national shoreline authorized by Section 106 of Public Law 90-483, approved 13 August 1968 which reads as follows:

> Sec. 106 (a) The Chief of Engineers, Department of the Army, under the direction of the Secretary of the Army, shall make an appraisal investigation and study, including a review of any previous relevant studies and reports, of the Atlantic, Gulf, and Pacific coasts of the United States, the coasts of Puerto Rico and the Virgin Islands, and the shorelines of the Great Lakes, including estuaries and bays thereof, for the purpose of (1) determining areas along such coasts and shorelines where significant erosion occurs; (2) identifying those areas where erosion presents a serious problem because the rate of erosion, considered in conjunction with economic, industrial, recreational, agricultural, navigational, demographic, ecological, and other relevant factors, indicates that action to halt such erosion may be justified; (3) describing generally the most suitable type of remedial action for those areas that have a serious erosion problem; (4) providing preliminary cost estimates for such remedial action; (5) recommending priorities among the serious problem areas for action to stop erosion; (6) providing State and local authorities with information and recommendations to assist the creation and implementation of State and local coast and shoreline erosion programs; (7) developing recommended guidelines for land use regulation in coastal areas taking into consideration all relevant factors; and (8) identifying coastal areas where title uncertainty exists. The Secretary of the Army shall submit to the Congress as soon as practicable, but not later than three years after the date of enactment of this Act, the results of such appraisal investigation and study, together with his recommendations. The views of concerned local, State, and Federal authorities and interests will be taken into account in making such appraisal investigation and study.
>
> (b) There are authorized to be appropriated such amounts, not to exceed $1,000,000, as may be necessary to carry out the provisions of this section.

PURPOSE

This report is a general summary of information on the shoreline of Louisiana including data on the extent and nature of erosion, identification of problem areas, ownership, and present use.

SCOPE

Data have been compiled from prior studies, studies now underway, aerial photographs, construction and maintenance of existing Corps of Engineers' navigation and flood control projects, quadrangle maps, and general information available in the New Orleans District files and from other sources. Data for the report have been furnished by the following:

U. S. Coast and Geodetic Survey, Rockville, Maryland
U. S. Soil Conservation Service, Alexandria, Louisiana
U. S. Fish and Wildlife Service, Atlanta, Georgia
U. S. Bureau of Mines, Bartlesville, Oklahoma
U. S. Coast Guard, Eighth District, New Orleans, Louisiana
Louisiana Department of Public Works, Baton Rouge, Louisiana
Louisiana Wild Life and Fisheries Commission, New Orleans, Louisiana
Coastal Studies Institute, Louisiana State University, Baton Rouge, Louisiana
Louisiana State Parks and Recreation Commission, Baton Rouge, Louisiana
Louisiana State Land Office, Baton Rouge, Louisiana
Iberia Parish Police Jury, New Iberia, Louisiana
Terrebonne Parish Police Jury, Houma, Louisiana
St. Tammany Parish Police Jury, Covington, Louisiana
St. Charles Parish Police Jury, Hahnville, Louisiana
Orleans Levee District, New Orleans, Louisiana
City Planning Commission of New Orleans, Louisiana
Board of Zoning Adjustments, New Orleans, Louisiana
Town of Mandeville, Louisiana

COORDINATION

Federal, State, and local agencies were requested to provide any available data bearing on the shoreline conditions for use in this report. Those furnishing data are shown in the preceding paragraph.

Section II
DESCRIPTION OF COASTAL AREAS

PHYSICAL CHARACTERISTICS

GENERAL

The existing Louisiana shoreline is the result of the deposition of Mississippi River sediments during the last 6,000 years and the action thereon by the waters of the Gulf of Mexico. The Louisiana shoreline consists of the lands bordering on the Gulf of Mexico and on the many sounds, bays, lakes, rivers, bayous, and other bodies of water extending inland therefrom. The areas adjacent to the coastal shoreline are generally composed of very low marsh, natural levees along existing and abandoned streams, chenieres,[1] and isolated barrier islands. Principal developments in the coastal area are those associated with the location, development, and extraction of large mineral (petroleum, natural gas, sulphur, salt, and shells) and fishery resources. The major streams flowing through the coastal area are Sabine, Calcasieu, Mermentau, Vermilion, Atchafalaya, Mississippi, and Pearl Rivers, Charenton Drainage Canal, Wax Lake Outlet, and Bayou Lafourche (see plates 1 and 2A through 10A). Only the Atchafalaya and Mississippi Rivers and the Wax Lake Outlet carry any appreciable sediments to the coastal area and the Gulf of Mexico.

SHORELINE LENGTH

The Gulf of Mexico shoreline and the shoreline of major sounds, bays, lakes (including Lake Pontchartrain), and rivers, as shown on plates 2A through 10A, have been inventoried in this report. The lengths of the gulf shoreline and the bay, lake, and estuarine shoreline are 810 miles and 1,133 miles, respectively. The tidal shoreline of bayous and marsh islands in the sounds, bays, and lakes is not reflected in these mileages. The lengths of shoreline in this report were determined from coast charts of the U. S. Coast and Geodetic Survey, scale 1:62,500 and 1:250,000; quadrangle maps of the U. S. Geological Survey, scales 1:24,000 and 1:62,500; U. S. Army Corps of Engineers maps 1:62,500 and 1:250,000; the Official Map of Louisiana, scale approximately 1 inch equals 6 miles; and uncontrolled mosaics of the coastal area prepared from aerial photographs flown in 1968 and 1969, scale approximately 1:20,000. The plates used in this report were developed from the U. S. Geological Survey map of the State of Louisiana, scale, 1:500,000, compiled in 1966, edition of 1968.

DESCRIPTION

GENERAL

The shoreline of Louisiana may be divided into two broad categories: a gulf shoreline facing the Gulf of Mexico and a bay-sound shoreline located along the banks

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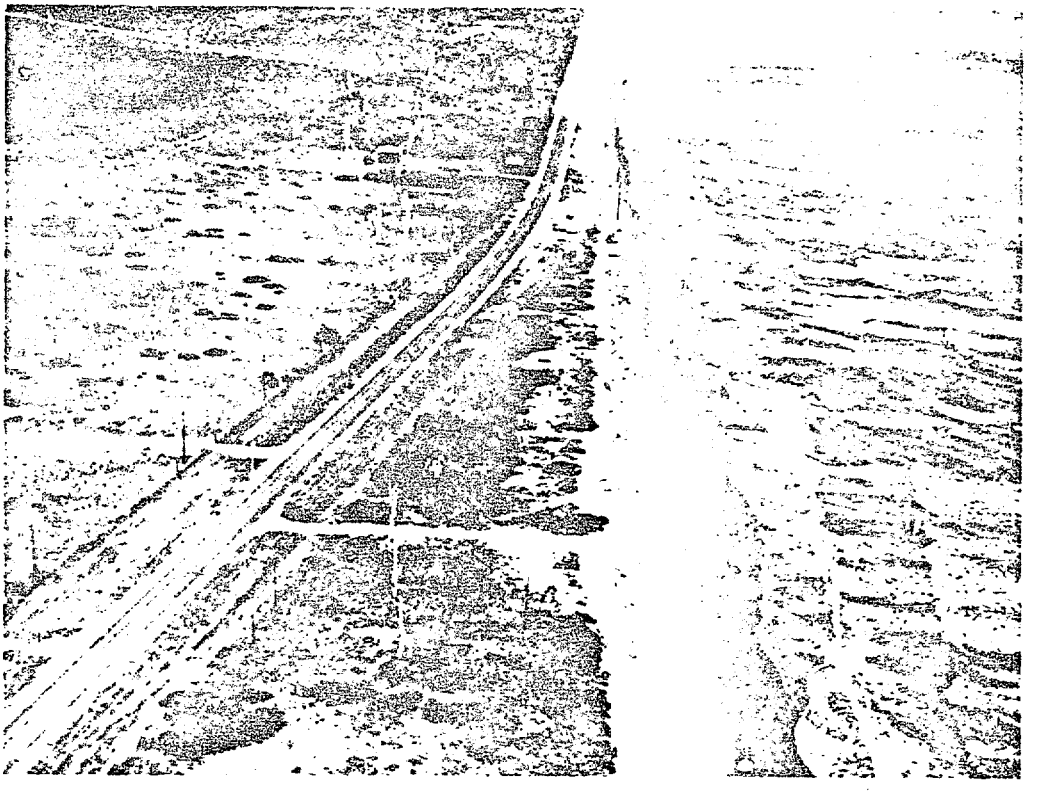
[1] *An ancient beach, stranded in the marshland.*

of tidal inlets, channels, distributaries, and around lakes and protected bays. In this report, the Louisiana shoreline has been subdivided into seven zones as shown on plate 1. Each zone is described in subsequent subparagraphs. Information on the shorelines is summarized in table 1 attached hereto.

ZONE I

General. This zone extends from the Sabine River to the Southwest Pass of Vermilion Bay. It includes the eastern shoreline of Sabine Lake and Sabine Pass and the shorelines of Calcasieu Lake and the channels connecting the lake to the gulf (plates 2A, 3A, and 4A). Zone I is located in Calcasieu, Cameron, and Vermilion Parishes. The area consists of vegetated marsh; water bodies including lakes, tidal inlets, streams, and rivers; chenieres; and beaches. Relief of the land area is slight with elevations ranging from 10 feet mean sea level (msl)[2] on top of the chenieres to 1 or 2 feet in the surrounding marsh.

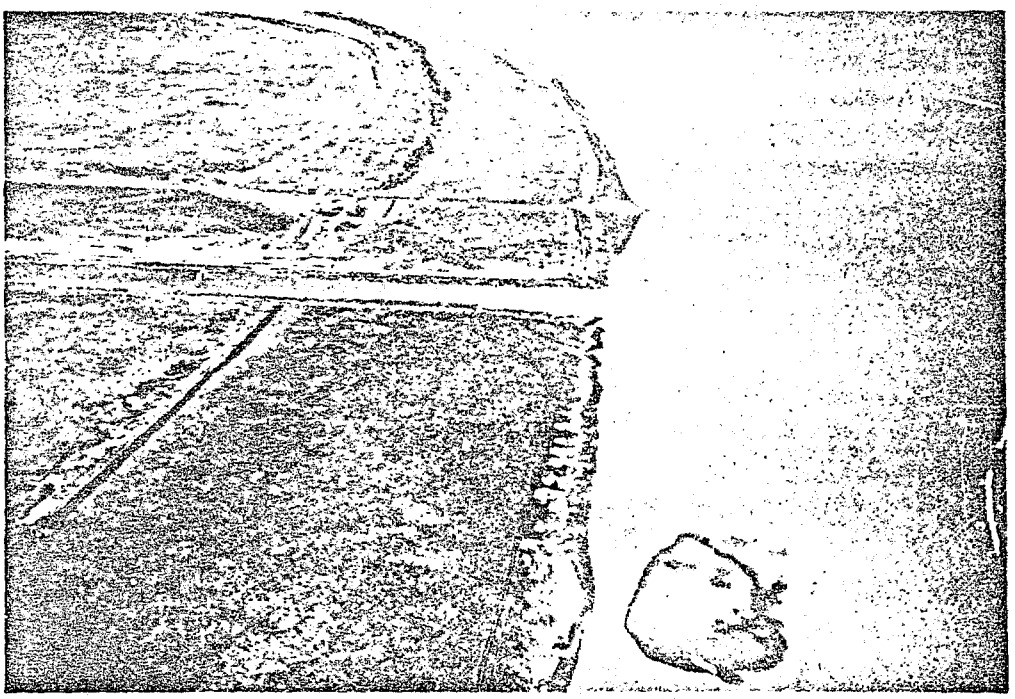
The gulf shoreline, about 114 miles in length, is relatively smooth with about 96 miles of sand beaches and 18 miles of mud and/or silt shoreline. From Sabine Pass to Calcasieu Pass, the shoreline is predominantly sand with varying amounts of shell derived



Gulf Shoreline of Peveto Beach, May 1971

[2]*All elevations in this report are in feet above mean sea level (msl) unless otherwise stated.*

Spoil at Calcasieu River and Pass Jetties, August 1970



Mudflats at Mouth of Freshwater Bayou Canal, October 1970

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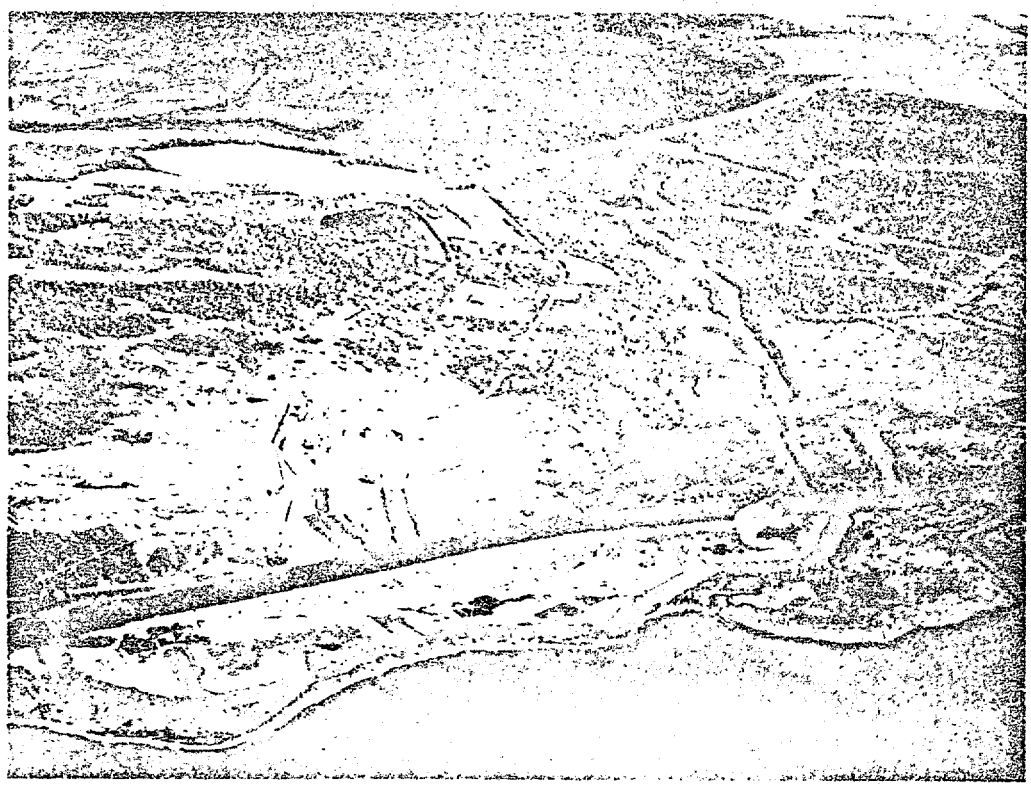
from coastwise movement of material deposited when the Mississippi River was constructing a huge delta in southwestern Terrebonne Parish. The 7 miles of shoreline east of and adjacent to the Calcasieu River are composed of mud and silt resulting from the reworking of marsh deposits. East of this area to about longitude 92°23' (plate 3A) the beach area is composed predominantly of sand with varying amounts of shell derived in part from reworking of chenieres and to a lesser degree from the Mermentau River. Extensive offshore mudflats have developed in some areas but they do not cover the beach zone. The next 11 miles of shoreline, eastward to about longitude 92°12', are comprised of extensive mudflats. This material has been transported from the Atchafalaya River by littoral currents. The remainder of the shoreline of Zone I to the Southwest Pass of Vermilion Bay is composed essentially of sand which has been reworked from nearby chenieres and offshore shoals.

The bay-sound shoreline of Zone I consists of about 71 miles of sand beaches and about 25 miles of mud and/or silt. Generally, these sand beaches consist of a surface veneer a few inches to a foot thick confined to the immediate shoreline and overlying soft marsh deposits. The sand beaches include the northern half of the eastern shore of Sabine Lake, the gulfward third of Sabine Pass, all of the shoreline of Calcasieu Lake, except the northern one-third of its eastern shoreline, and the banks of Calcasieu Pass. Mud and/or silt predominate along the remainder of the bay-sound shoreline in Zone I. The coarser materials found in Sabine and Calcasieu Passes are from a reworking of the stranded shorelines cut by these passes.

ZONE II

General. This zone extends from Southwest Pass of Vermilion Bay eastward to Point au Fer. It includes the shorelines of Marsh Island and Vermilion, West and East Cote Blanche, Atchafalaya and Fourleague Bays (plates 4A and 5A). Zone II is located in Vermilion, Iberia, St. Mary, and Terrebonne Parishes. It is characterized by an indented gulf shoreline on the gulf side of Marsh Island, and a generally smooth bay-sound shoreline except along the bay side of Marsh Island, where subsidence and differential erosion have resulted in an indented shoreline. The area consists of marshes; natural levees along Bayous Sale and Cypremort; large bodies of water including bays, lakes, and streams; reef zones; and beaches. Relief is very slight with maximum elevations of about 7 feet found along the crests of the beaches in the vicinity of Mound Point on the southern shoreline of Marsh Island. Elevations of about 5 feet are found along the crests of the natural levees along Bayous Sale and Cypremort. Exceptions to this are in the vicinity of Belle Isle, Cote Blanche Island, and Weeks Island where salt domes cause the land elevations to reach 50 to 125 feet.

The gulf shoreline, about 21 miles in length, is located along the southern shore of Marsh Island from the Southwest Pass of Vermilion Bay to South Point. It is composed of 16 miles of sand and shell beaches and about 5 miles of mud and/or silt shoreline. Large sand and shell beaches are located along the gulf shoreline from the Southwest



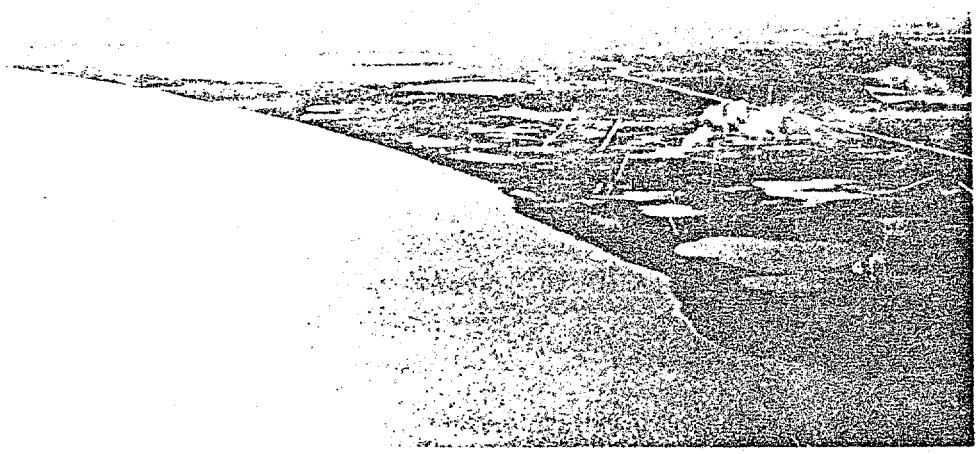
Weeks Island Salt Mine on Vermilion Bay, March 1971

Pass of Vermilion Bay eastward to the vicinity of longitude 91°52'30" . Discontinuous pocket beaches of oyster reef detritus, derived from offshore reefs, mixed with minor amounts of sand exist eastward from longitude 91°52'30" to Mound Point. Mud and silt, transported from the gulf side of the Point au Fer shell reef by littoral currents, blanket the shoreline between the pocket beaches. Sand beaches predominate from Mound Point to South Point.

The bay-sound shoreline of Zone II consists of about 104 miles of beaches comprised of sand material with varying amounts of shell material and about 146 miles of mud and/or silt shoreline (plates 4A and 5A). Approximately 22 miles of the latter are covered by decayed organic matter. As a result of reworking of material and general shoreline retreat, the sand and shell beaches consist of a surface veneer a few inches to a foot thick overlying soft marsh deposits and are confined to the immediate shoreline. Bays comprising the bay-sound shoreline of Zone II are described in the following paragraphs.

Vermilion Bay, the largest and deepest of the five bays in Zone II, consists of a series of discontinuous sand beaches with localized concentrations of shell material. These materials were derived from the truncation of natural levee ridges, Pleistocene[3]

[3]*The Pleistocene Epoch, or glacial age, which lasted from about 1,000,000 years ago to about 15,000 to 20,000 years ago.*



North Shoreline of Vermilion Bay, May 1971

outcrops and shell middens.[4] Generally, the shoreline between the sand beaches consists of silt accumulations. From the general vicinity of Vermilion River along the northern shore of Vermilion Bay to the general vicinity of longitude 92°00' mud and/or silt shorelines predominate. A small section of the northern shore of Vermilion Bay (between longitude 92°00' and 91°52') is composed of sand material. Along the eastern perimeter of Vermilion Bay, the predominant shoreline type is mud flanked by an extensive deposit of black, organic flakes and particles referred to by the local inhabitants as "coffee grounds." These materials are derived from decaying water hyacinth and allegator weed which grow abundantly in the ponds and bayous that drain into the bay.

West and East Cote Blanche Bays are separated from Vermilion Bay by the Terrapin Reef Zone which is anchored on the firm material of the submerged remnant of the natural levees along Bayou Cypremort. The southern shoreline of West Cote Blanche Bay, along Marsh Island, is predominantly mud and silt with local thick accumulations of clamshells forming small beaches. These shells are the result of storm wave action and are derived at least in part from the Terrapin Reef. The northwestern shoreline of West Cote Blanche Bay, from the mouth of Bayou Cypremort to Cote Blanche Island, consists generally of alternating reaches of sand and mud or silt beaches. Beaches are absent in zones of active retreat. A wave-cut scarp 0.5 to 1.0 foot high exists at the shoreline. East of Cote Blanche Island, sand beaches with local concentrations of shell material predominate. South of the mouth of the Charenton Drainage Canal "coffee grounds" blanket much of the shoreline to the general vicinity of Marone Point. West and East

[4] *An accumulation of refuse—mainly shell, near a former Indian dwelling place.*

Cote Blanche Bays are separated by Marone Point and Lake Point. Material at these two points consists of marsh deposits, indicating that both bays are the result of wave action enlarging two originally large, round inland lakes. Between Marone Point and Point Chevreuil, sand beaches predominate. A small concentration of silt and mud exists in the vicinity of the mouth of Bayou Sale. The coarser material is the result of reworking of the submerged and remnant natural levees of Bayou Sale.

Atchafalaya Bay is separated from East Cote Blanche Bay by the submerged natural levee ridges of Bayou Sale, and from the Gulf of Mexico by the Point au Fer shell reef. It is the second largest of the five bays in Zone II. Generally, the beaches around the bay consist of a ridge 2 to 3 feet high, varying in width from 25 to 100 feet, composed of shells and shell fragments concentrated by wave action. Decaying organic masses ("coffee grounds") are at times found resting on the beach front, but these are not so extensive as the tremendous accumulations found along the eastern shoreline of Vermilion and West Cote Blanche Bays. The Point au Fer shell reef, while not considered here as part of the existing Louisiana shoreline, is a major physiographic feature contributing substantially to the configuration and composition of the Atchafalaya Bay shoreline. The reef extends in an almost straight line from Point au Fer on the east to within 10 miles of Marsh Island on the west. It consists of irregularly shaped bodies of cemented oyster shells interconnected for distances of several miles. Water depths over the major portion of the reef are 1 foot or less. Exceptions to water depth in this area are in the general vicinity of longitude 91°30' where depths of 4 to 5 feet are encountered. The reef is a barrier to gulf storm waves and gulf saline waters. It also is a source of material for the numerous shell beach ridges surrounding the bay.

Halters Island, Between Atchafalaya and Fourleague Bays, September 1965

Fourleague Bay is an arm of the Atchafalaya Bay. Its shoreline consists predominantly of mud and silty material derived in part from reworking of the surrounding marshes, and in part from sediments transported into the bay from the Atchafalaya Bay, the Gulf of Mexico, and the surrounding marsh.

ZONE III

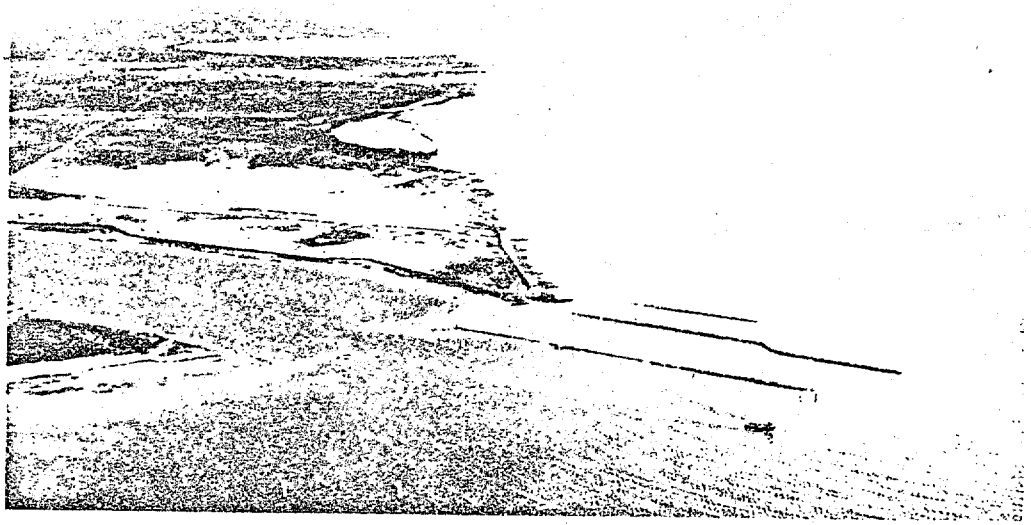
General. This zone extends from the Atchafalaya Bay at Point au Fer to Bayou Goreau (longitude 91°05'). It is located in Terrebonne Parish. The area consists of a large expanse of flat-lying marsh, a few small lakes, tidal inlets, and a gulfward facing beach ridge. Relief is almost nonexistent except for the 2- to 3-foot high beach ridges paralleling the gulf shoreline.

The gulf shoreline includes the southern shore of Point au Fer Island and about 4 miles of shoreline to the east of the island. It is characterized by a smooth curving shoreline, an abundance of shell, and rather coarse sand material. Of the 21 miles of shoreline in the zone, about 9.5 miles consist of shell detritus and sand material. The remaining 11.5 miles are sand with varying amounts of shell detritus. The major concentration of shell detritus is located west of longitude 91°15'. An exception to this is the localized concentration of shell material just west of Bayou Goreau. The apparent source of the shell material is the Point au Fer shell reef. Even though the predominant littoral current is westward, storm action and temporarily reversed current direction have carried the shell detritus slightly eastward. The sand has been transported from Isles Dernieres in Zone IV by littoral currents and deposited along the gulfward facing beach.

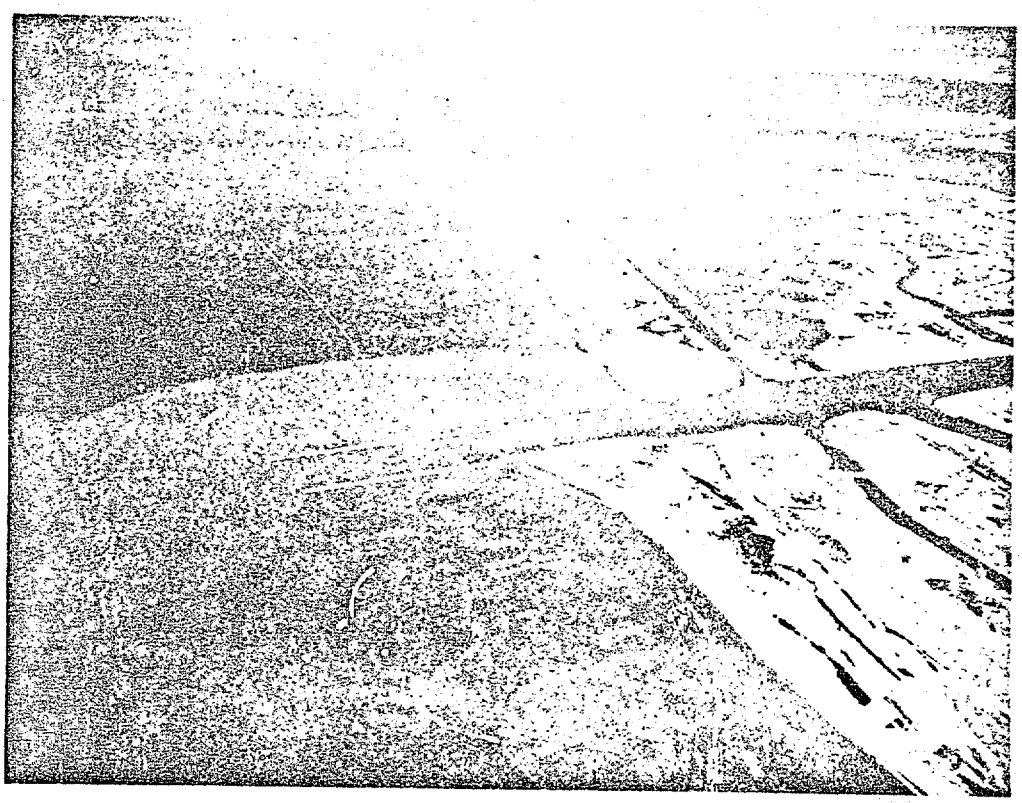
ZONE IV

General. This zone extends from Bayou Goreau eastward to Sandy Point near longitude 89°29'30". It includes the shorelines of: Caillou Bay; Lake Pelto; Terrebonne Bay; Lakes Barre, Felicity, and Raccourci; Timbalier, Caminada, and Barataria Bays; and many smaller lakes and bays in the coastal area (plates 5A, 6A, and 7A). Zone IV is located in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes. The area is characterized by barrier islands possessing smooth, curved seaward edges and irregular leeward shorelines and a highly irregular and heavily indented leeward zone of numerous bays and lakes. The area includes the natural levees along Bayou Teche, Bayou Lafourche, and the Mississippi River; a chain of offshore barrier islands; extensive flat marshlands; and numerous bays, lakes, tidal inlets, and streams which lie landward of the barrier islands and between the natural levee ridges. Relief is slight with elevations ranging from a maximum of 4 to 6 feet on the crests of the sand beaches on the barrier islands to a minimum of 1 or 2 feet in the marshes.

The gulf shoreline is composed entirely of sand beaches with only very minor amounts of mud and/or silt scattered along the 100 miles of coastline. Generally, the sand beaches are continuous from the western tip of Isles Dernieres to Sandy Point. Sand predominates along the northern shore of Caillou Bay except for the section between Bayou Grand Caillou and Pass Wilson where shell beaches are located. The sands found



Belle Pass Jetties at Mouth of Bayou Lafourche, May 1971



Jetties at Mouth of Empire to Gulf of Mexico Waterway, January 1970

along Isles Demeres, Timbalier Island, East Timbalier Island, and the shoreline in the general vicinity of Belle Pass are derived from the reworking of the ancient Lafourche Delta, mainly Bayous Lafourche, Terrebonne, and Petit Caillou. Some of these sands have been transported east of Bayou Lafourche by the prevailing eastward trending littoral currents in this area.

The bay-sound shoreline consists of about 174 miles of sand beaches and approximately 242 miles of mud and/or silt shoreline. The sand beaches consist generally of only a surface veneer of sand a few inches to a foot thick overlying soft marsh deposits, and are confined to the immediate shoreline. In the general vicinity of Pelican Lake a mud shoreline has developed from enlargement of the lake within the marsh. Sand beaches predominate along the shoreline of Lake Pelto from Pelican Lake to Bayou Petit Caillou. The source of most of the sand is the reworking of the coarser natural levee deposits and abandoned distributary material of Bayou Petit Caillou. Mud and/or silt shorelines, some exhibiting wave-cut scarps, are the primary type shoreline along the western shore of Terrebonne Bay to the vicinity of Bayou Terrebonne, the result of reworking of the marsh deposits. Very small localized beaches are scattered throughout this reach. From Bayou Terrebonne, around the shorelines of Lake Barre, Lake Felicity, and Lake Raccourci to the vicinity of Grand Bayou Blue, the primary shoreline material is sand derived from the reworking of sediments deposited by Bayou Terrebonne when it was active in the area. Within this area, there are two zones where localized shell beaches have accumulated—one along the northern shore of Lake Barre, and the other along the northeastern shoreline of Lake Raccourci. From Grand Bayou Blue southward, the remaining eastern shoreline of Timbalier Bay is predominantly mud and/or silt. The bay-sound shoreline paralleling the leeward edge of the barrier islands of Isles Dernieres, Timbalier, and East Timbalier Island consists primarily of sandy material. The shoreline around Caminada Bay, Barataria Bay, and smaller adjacent bays is mainly mud and/or silt with only traces of sandy material. This continuous mud and/or silt accumulation is broken in the section along the western shoreline of Caminada Bay and along the northern shorelines of Barataria Bay by small localized shell beaches. The remaining bay-sound shoreline in Zone IV is almost entirely mud and/or silt with a scattering of sand beaches concentrated around the northwestern, northern, and eastern shorelines of Bastian Bay. The sand material is derived from a reworking of material deposited by Grand Bayou.

ZONE V

General. This zone extends from Sandy Point eastward around the present Mississippi River Delta to California Point at the south side of California Bay (plates 7A and 8A). It includes the shoreline of West, East, Garden Island, and Blind Bays, and many other intervening bays between Sandy and California Points as well as the major distributary channels of the Mississippi River. The area is an active delta zone with an extremely irregular shoreline and very few well developed sand beaches. Of the 321 miles of shoreline in this zone about 106 miles are comprised of bay-sound shoreline which consists of the major passes of the Mississippi River. The remaining 215 miles are gulf shoreline. Features

of the area include: natural levees along the Mississippi River and its passes; numerous bays, lakes, tidal inlets, and channels; and sand spits and mud lumps developed at or near the mouths of the passes. Relief is slight with elevations ranging between 2 to 4 feet on the crests of the natural levees to sea level in the surrounding marshlands.

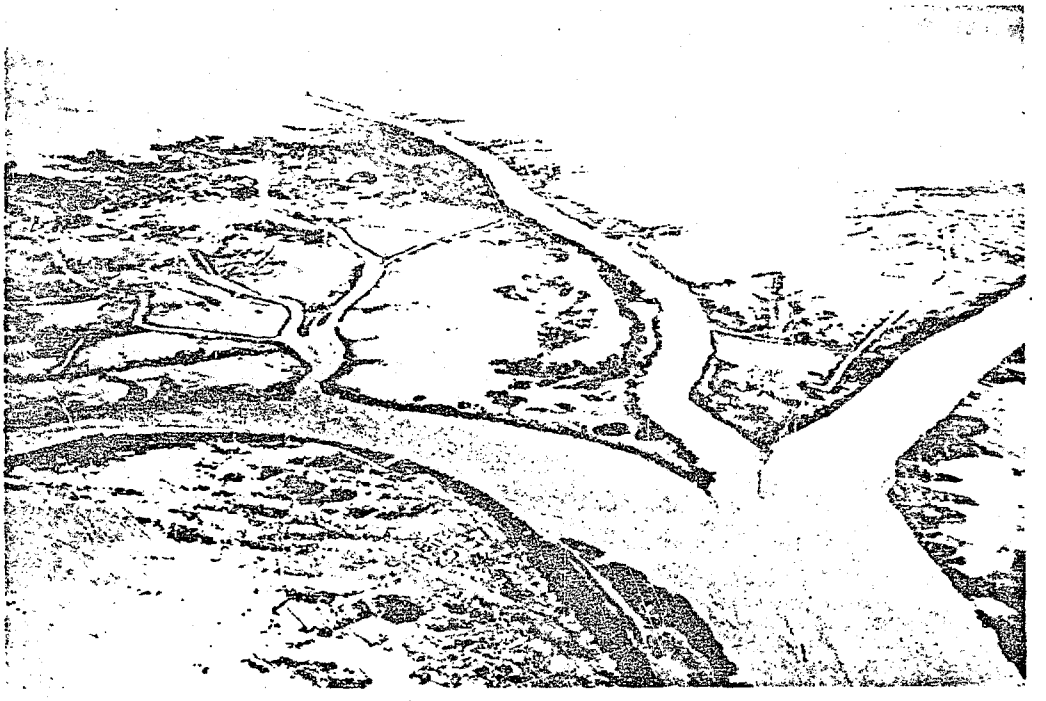
The gulf shoreline consists of about 29 miles of sand beaches and 186 miles of mud and/or silt. From Sandy Point to West Bay, the shoreline consists primarily of sand with minor amounts of mud and/or silt. The primary sources of this material are the small distributaries of the Mississippi River at Venice, such as Grand and Tiger Passes. The shoreline of West Bay and adjacent inland bays are predominantly mud and/or silt with a few scatterings of sand beach material located principally around Grand Pass where sediments are being carried into the area. Sandy material, derived from sediments carried from Southwest Pass blankets the eastern gulf shoreline of the pass while mud and/or silt material predominates along the western gulf shoreline. Mud and/or silt material predominates along the shoreline extending from Customhouse Bayou through East Bay. Sand beaches at a few scattered locations along the South Pass shoreline of East Bay are the result of minor crevassing along the pass. The shoreline around the mouth of South Pass is sand except for a section of mud and/or silt on the west shoreline. The primary material along the shoreline of Garden Island Bay, Blind Bay, and intervening bays to California Point, as shown on plates 7A and 8A, is mud and/or silt. Local concentrations of sand material exist in areas where distributaries discharge into the bays. The fine material is generally a result of reworking of the marsh deposits and deposition of fine material brought in by the numerous distributaries. Across the gulf shoreline between Northeast and Southeast Passes is an almost continuous reach of sand spits and beaches derived from the sediments carried by the passes. A particularly good barrier beach has developed just east of the mouth of Southeast Pass. Intermittent sand beach development, separated by mud, exists across the advancing front of Pass a Loutre and across the myriad of smaller passes to the vicinity of Main Pass. The source of all this sand is the sediment carried into the area by the numerous distributaries of the Mississippi River.

The bay-sound shoreline in Zone V, approximately 106 miles, encompassing the bank lines on both sides of Southwest Pass, South Pass, Pass a Loutre, and Main Pass, is composed entirely of mud and/or silt deposited by the Mississippi River.

ZONE VI

General. This zone extends from California Point northward and eastward to Isle au Pitre. The zone is located in Plaquemines and St. Bernard Parishes. It includes the Chandeleur Islands and the shorelines of Breton and Chandeleur Sounds and numerous bays and lakes. The area is characterized by an arc of barrier islands possessing comparatively smooth gulfward edges and irregular leeward shorelines, an extremely irregular and heavily indented zone of bays along the mainland, and a lack of bay-sound shoreline. The principal features of the area include natural levees along the former

Southwest Pass of Mississippi River, February 1971



Head of Passes of Mississippi River, February 1971

distributaries of the Mississippi River; a chain of offshore barrier islands; extensive flat marshlands; and numerous bays, lakes, tidal inlets, and streams which lie between the natural levee ridges. Relief is slight in the marshland area with maximum elevations of 1 to 3 feet along the crests of the remnant natural levees and minimum elevations of at or near sea level in the surrounding marsh. Maximum elevations along the barrier islands range between 2 and 10 feet.

The gulf shoreline, about 314 miles in length, consists of about 94 miles of sand beaches and 220 miles of mud and/or silt. The gulfward shoreline of Breton and Chandeleur Islands (plates 8A and 9A) is composed of sand and shell beaches which are the results of the erosion and sorting of coarse material from the ancient St. Bernard Delta. Generally, the sand beaches in the Chandeleur Island group consist of a 5- to 10-foot layer of sand overlying soft to medium bay-sound and marsh deposits. An exception to this is Breton Island where sand beaches are about 30 feet thick. The remaining sand beaches are composed primarily of a surface veneer, a few inches to a foot thick, overlying soft marsh deposits and are confined to the immediate shoreline. The shorelines of Breton Sound, from California Point to Point Gardner, consist primarily of mud and/or silt and in places exhibit a wave-cut scarp several inches high. Local concentrations of shell material are found in the vicinity of Mozambique Point as a result of reworking of shell middens. At Point Gardner a small sand beach with some shell has developed from a reworking of material deposited by Bayou Terre aux Boeufs and other minor former distributaries. From Point Gardner to Point Paulina, and around Chicot Island, the shorelines of the bays are about 75 percent mud and/or silt and 25 percent sandy beach material. Generally, the sandy material is concentrated around the distal ends of old distributaries such as at Chicot Island and Point Lydia near Bayou La Loutre, and Point Eloi where the material has been reworked and winnowed. Local concentrations of small shell beaches are found along the entire section between Point Gardner and Point Paulina, the result of destruction and reworking of shell middens along the old distributaries. From Point Paulina to Mitchell Island (also called Mitchell Key), mud and/or silt is the primary shoreline material, sometimes exhibiting a wave-cut scarp. An exception to this is in the vicinity of Mitchell Island where reworking of the ends of an old distributary and attendant shell middens has resulted in the formation of a sand and shell beach. The remaining gulf shoreline in Zone VI consists of about 37 miles of mud and/or silt and 22 miles of sand beaches. The sandy material is concentrated generally around the north shore of Drum Bay from Door Point to Grand Pass and from Bayou Pierre to Isle au Pitre where the ends of the minor old distributaries have been reworked. Small local concentrations of shell beaches are located in the section, mainly between Door Point and Isle au Pitre. Most of the shell material is from the reworking of shell middens that were concentrated on the old distributaries.

ZONE VII

General. This zone extends from Isle au Pitre westward along the shoreline of Mississippi Sound and around Lake Borgne, St. Catherine, and Pontchartrain to the mouth

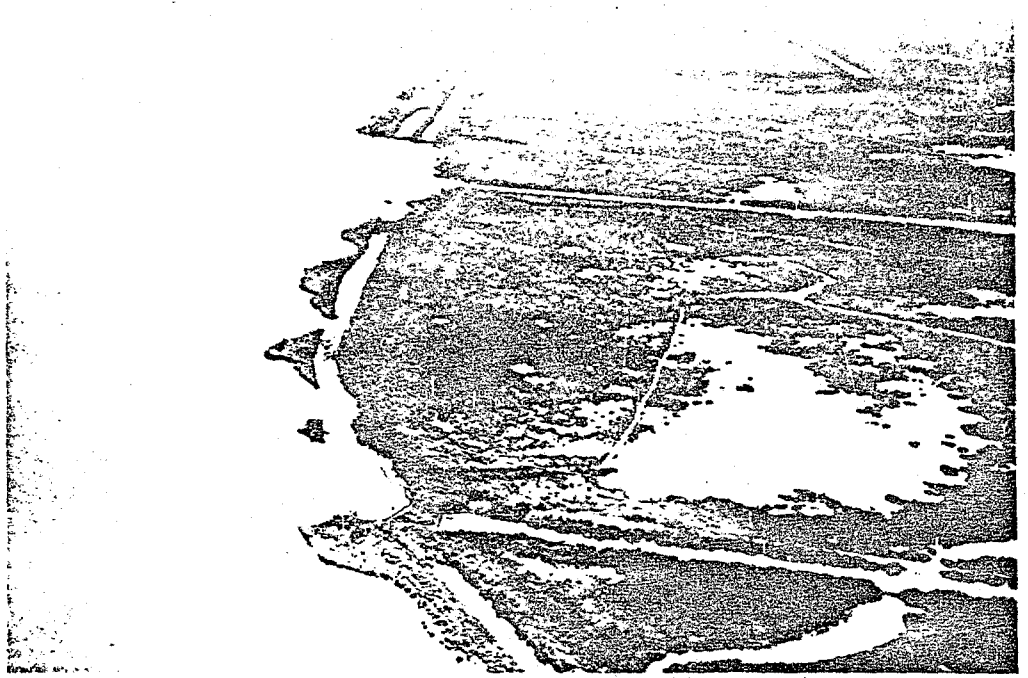
of Pearl River. It includes both banks of Chef Menteur Pass and The Rigolets. Zone VII is located in St. Bernard, Orleans, Jefferson, St. Charles, St. John the Baptist, Tangipahoa, and St. Tammany Parishes. It is characterized by large inland lake areas with comparatively smooth shorelines. The zone can be divided into two rather distinct units. One unit includes the shorelines of the Mississippi Sound and Lake Borgne and St. Catherine, and is dominated by such features as: remnant natural; extensive flat marshlands; and numerous bays, small lakes, tidal inlets, and streams. The second unit, encompassing Lake Pontchartrain, exhibits flat swamps and marshlands; Pleistocene terraces; and rather extensive beaches. Relief varies from very slight around the periphery of Lake Borgne where maximum elevations of 1 or 2 feet are found along remnant natural levee crests, to slightly moderate on the north shore of Lake Pontchartrain in the vicinity of Mandeville where elevations reach 5 feet at the shoreline and rise to 20 to 25 feet on the Pleistocene terrace, about one-half mile from the shoreline.

The gulf shoreline of Zone VII consists of about 9 miles of sand beaches and about 16 miles of mud and/or silt. From Isle au Pitre to Johnson Bayou, the shoreline is composed of sandy beaches and small local shell beaches. Source of the sand is the reworked sediments from several old distributaries in the area. The shell material is from reworked shell middens that were located along the distributaries. Along the remaining southern shoreline of the Mississippi Sound to Malheureux Point, the predominant material is mud and/or silt derived from reworking of the surrounding marshlands.

The bay-sound shoreline consists of 121 miles of sand beaches and 144 miles of mud and/or silt. Along the eastern shoreline of Lake Borgne from Malheureux Point to Pointe Aux Marchettes, the predominant shoreline material is mud and/or silt derived from reworking of the surrounding marshlands. From Pointe Aux Marchettes to the mouth of Bayou Bienvenue, a sand beach exists except for a small section of mud and/or silt between Jahnckes Ditch and Bayou Ysclosky. Small local concentrations of shell material overlap the sandy beaches in some areas of this section. The sand is derived from a reworking of sediments deposited by old distributaries and the shell from destruction of shell middens such as now exist at the mouth of Jahnckes Ditch. The remaining shoreline of Lake Borgne from Bayou Bienvenue to Pearl River is predominantly mud and/or silt, with only minor amounts of sand located between The Rigolets and the Pearl River and with a few scatterings of shell material derived from reworking of surrounding sediments and shell middens. The banks of The Rigolets and Chef Menteur Pass, and the shoreline of Lake St. Catherine are composed entirely of mud and/or silt derived from surrounding marshlands. From The Rigolets west to Pointe aux Herbes intermittent shore types, from sandy to mud exist, and from Pointe aux Herbes to the general vicinity of Lincoln Beach, sand predominates. Around Pointe aux Herbes, several small beaches are recognizable. The abundance of sand south of Pointe aux Herbes and the existence of shell material is attributed to the reworking of the materials of old distributaries.

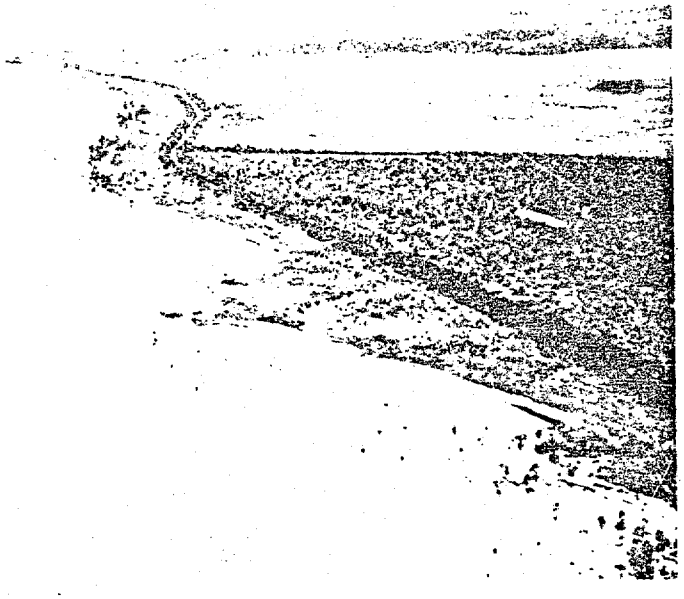
From Lincoln Beach along the shoreline of Lake Pontchartrain to New Orleans Airport, mud and/or silt are predominant. The shoreline between the New Orleans Airport

Lake Borgne at Chef Menteur Pass, August 1970



St. Charles Parish Shoreline of Lake Pontchartrain, August 1970

Lake Pontchartrain at Mouth of Tangipahoa River, August 1970



Lake Pontchartrain Shoreline near Lewisburg, August 1970

and the Jefferson-Orleans Parish line is protected by a concrete seawall with lakeward beaches at two locations, and from the Jefferson-Orleans Parish line to the Jefferson-St. Charles Parish line by a revetment of asphalt and riprap (see photographs on pages 27 and 47). From the Jefferson-St. Charles Parish line to the vicinity of the Tangipahoa River in the northwest corner of Lake Pontchartrain a few small, discontinuous beaches of fine sand and shell exist. Generally, the sand material results from the destruction of some former ridge left behind by a retreating shoreline, while the shells are the result of natural concentration by wave action from deposits on the lake bottom or from destroyed shell middens. In the vicinity of the Tangipahoa and Tchefuncta Rivers small localized shell beaches have developed. In addition, just west of the Tchefuncta River, a small sand beach has developed, the result of a reworking of onshore materials, primarily from Miltons Island. The remaining bay-sound shoreline in Zone VII extends from the Tchefuncta River eastward to The Rigolets and consists predominantly of sand with minor amounts of mud and/or silt. The primary source of the sand has been the reworked Pleistocene material brought into the area by streams flowing off the Pleistocene terraces into Lake Pontchartrain. Another source of the sand is the submerged Milton Island beach (averaging about 2,000 feet in width) which parallels the northern shoreline 3 to 6 miles offshore and comes onshore in the vicinity of Bayou Lacombe.

SHORE OWNERSHIP

The coastal area of Louisiana is generally marsh and inaccessible for several miles inland. Until the discovery of oil and gas and development of the petroleum industry, it had a very low value as trapping land. Surveying was difficult and probably early surveys were somewhat inaccurate. The discovery of oil and gas has made all of the coastal area extremely valuable because of the subsurface mineral rights.

Under Louisiana law, the beds and bottoms of bays, lakes, and streams belong to the State; accretion on the shores of rivers or other streams belongs to the adjoining property owner; accretion of the gulf shoreline and arms thereto belongs to the State; and lands that become water bottoms due to erosion become state property. Due to difficulties in locating original surveys, determining accurately the facts of historical shore changes and applying the laws pertaining to erosion and accretion, actual ownership in many shoreline areas is uncertain until finally decided by the courts. The delineation of ownership of the Louisiana shore area adjacent to and above the high-water level, between private, public non-Federal, and Federal interests is shown on plates 2C through 10C and summarized in table 1. The Louisiana State Land Office furnished aerial survey maps of parishes having tidal shores on which they indicated the three land categories. Mileages of each category were determined from measurements of these maps. For reasons stated above, this information is very general.

PRESENT DEVELOPMENT

GENERAL

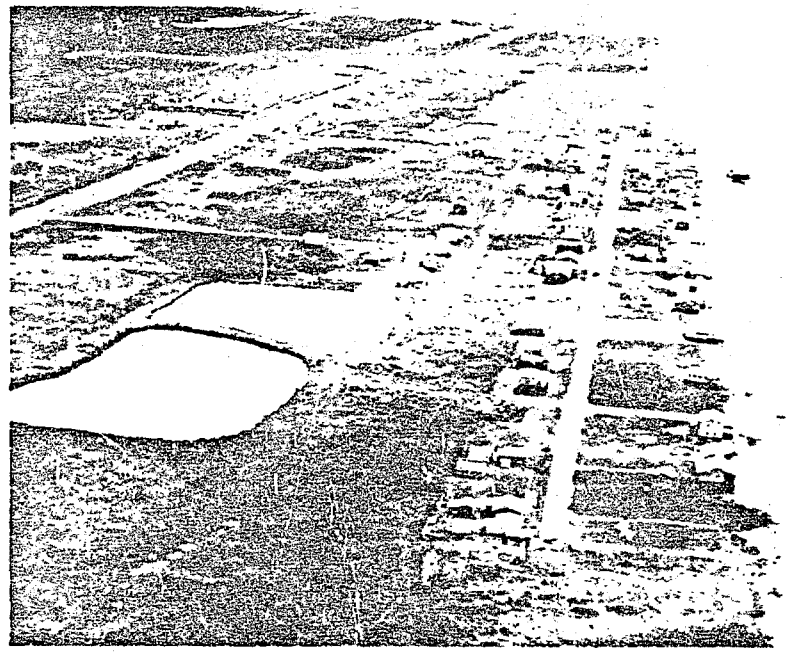
Louisiana has a highly developed system of inland waterways which serves fishermen, petroleum interests, and recreationists. Numerous shallow-draft channels interconnected by the Gulf Intracoastal Waterway provide access for barge traffic to cities and population centers in the coastal areas. The Mississippi and Calcasieu Rivers, the Mississippi River-Gulf Outlet (see photograph, page 37), and the Sabine-Neches Waterway provide oceangoing ships access to the deepwater ports of Baton Rouge, New Orleans, and Lake Charles in Louisiana and to Port Arthur, Beaumont, and Orange in Texas. Only a few areas of the gulf shoreline are accessible by land transportation. The Louisiana coastal area, including the offshore gulf area, produces abundant quantities of petroleum, natural gas, sulphur, salt, and shells. The coastal marsh and bays with their brackish and marine waters make Louisiana one of the leading states in shrimp and oyster production. The menhaden fishery in the offshore waters, one of the nation's largest, is directly dependent on the inshore waters for nursery grounds. A recent development is the establishment of a pet food industry to utilize the trash fish caught by shrimp trawlers. The coastal marsh is one of the most valuable fur-producing areas in the nation. It also serves as the wintering grounds for many valuable species of marsh and shore birds. Game preserves, wildlife refuges, and other wildlife management areas are shown on plate 1. Shore use is shown on plates 2D through 10D. Population statistics and projections for the coastal parishes are shown below.

Parish	Population (1,000's) 1930	1940	1950	1960	1970	2020[a]
Calcasieu	42.0	56.5	89.6	145.5	145.4	203.0
Cameron	6.0	7.2	6.2	6.9	8.2	11.0
Vermilion	33.7	37.8	36.9	38.8	43.1	60.0
Iberia	28.1	37.2	40.1	51.7	57.4	79.0
St. Mary	29.4	31.5	35.8	48.8	60.8	85.0
Terrebonne	29.8	35.9	43.3	60.8	76.0	124.0
Lafourche	32.4	25.3	42.2	55.4	68.9	115.0
Jefferson	40.0	50.4	103.9	208.8	337.6	569.0
Plaquemines	9.6	12.3	14.2	22.5	25.2	42.0
St. Bernard	6.5	7.3	11.1	32.2	51.2	86.0
Orleans	458.8	494.5	570.4	627.5	593.5	993.0
St. Charles	12.1	12.3	13.4	21.2	29.6	47.0
St. John the Baptist	14.1	14.8	14.9	18.4	23.8	40.0
Tangipahoa	46.2	45.5	53.2	59.4	65.9	129.0
St. Tammany	20.9	23.6	27.0	38.6	63.6	103.0
Total	809.6	892.1	1,102.2	1,436.5	1,650.2	2,686.0

[a] Based on Office of Business Economics Water Resources Planning Area population growth rates.

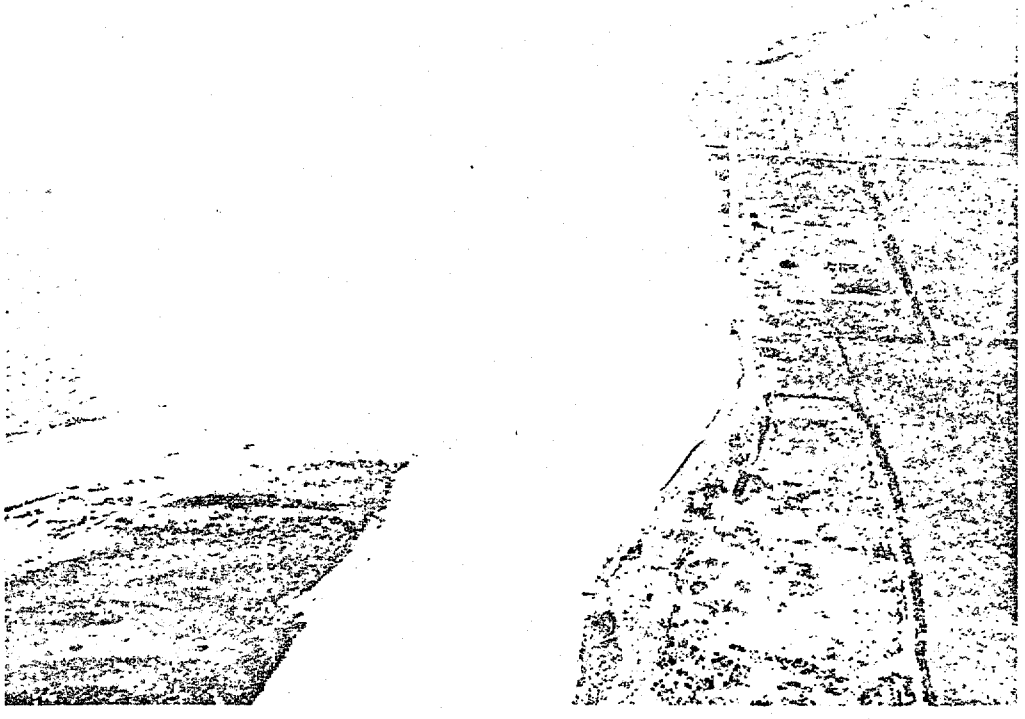
ZONE I

The major urban center in this zone is Lake Charles with a 1970 population of about 78,000. The gulf shoreline consists of 105.8 miles undeveloped, 5.9 miles of nonrecreational development which is an area where a highway runs adjacent to the shoreline (see photographs, page 45), 2.1 miles of private recreational development which consists of summer homes and small commercial establishments to serve tourists at Ocean View, Constance, Peveto, and Holly Beaches (see photograph, page 4), and 0.2 mile of public recreational developments at the state park at Rutherford Beach at the mouth of the Mermentau River. Recreational use of these beaches has developed due to their accessibility from and proximity to the Lake Charles area. Along the undeveloped shore in Zone I there are two game refuges, the state-owned and managed Rockefeller Wildlife Refuge, 27.0 miles in length, and the privately-owned Paul J. Rainey Wildlife Refuge and Game Preserve (Audubon Society) 18 miles in length. The shore of Sabine Lake and Pass, a total length of 30 miles, has only 0.2 mile of developed shore; a gas plant on the east shore of the pass where it opens to the lake. The shores of Calcasieu Lake have 2.7 miles of private recreational development which consists of weekend fishing and hunting camps on the northeastern shore of the lake. There are 4.2 miles of industrial development associated with the oil industry located in the channels connecting Calcasieu Lake to the gulf. The remaining 59.1 miles of the shoreline of Calcasieu Lake and connecting channels are undeveloped. The Federally owned Sabine Migratory Water Fowl Refuge has property on the undeveloped northeastern shore of Sabine Lake (9.9 miles) and the undeveloped southwestern and southeastern shores of Calcasieu Lake (17.3 miles).



Constance Beach, April 1970

Holly Beach, May 1971



Rutherford Beach State Park at Mouth of Mermentau River, April 1970

ZONE II

The gulf shoreline of this zone consists of the undeveloped southern shore of Marsh Island, a state-owned wildlife refuge. The most populous center is Morgan City with a 1970 population of about 16,600. On the eastern shore of Vermilion Bay, just south of Shark Island, there are 0.6 mile of public beach (Cypremort Beach) and 1.2 miles of weekend and summer camps. The remaining 248.2 miles of shore in Vermilion, West and East Cote Blanche, Atchafalaya and Fourleague Bays are undeveloped. The Paul J. Rainey Wildlife Refuge and Game Preserve owns about 2 miles of undeveloped shore on the western side of Southwest Pass and in Vermilion Bay west of Redfish Point. The Louisiana State Wild Life Refuge and Game Preserve occupies 20 miles on the southwestern shore of Vermilion Bay and all of the shoreline of Marsh Island.

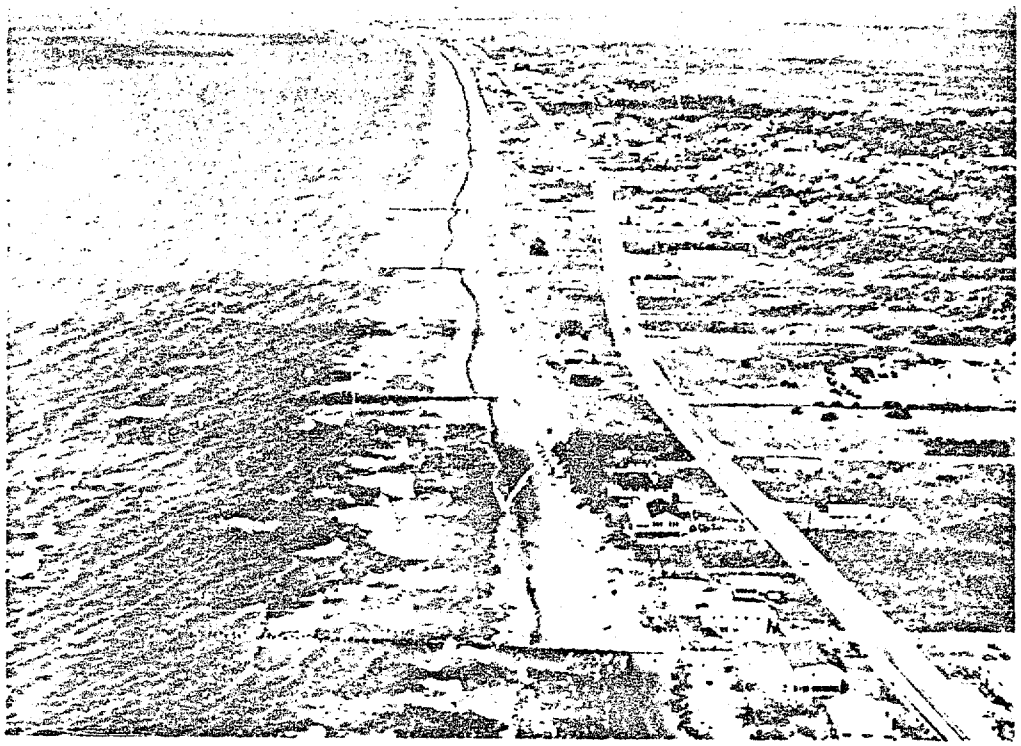
Cypremort Beach and Camp Development on Vermilion Bay, March 1971

ZONE III

Zone III has 21 miles of undeveloped gulf shoreline.

ZONE IV

The most populated area along the coast in this zone is the town of Grand Isle



Gulf Shoreline of Grand Isle, May 1971

with a 1970 population of about 2,200. The gulf shore has 1.5 miles of state parks, which includes public beaches at the western and eastern ends of Grand Isle, 5.8 miles of private beach with public access, and 1.3 miles of nonrecreational development consisting of oil-oriented industry at East Timbalier Island and a marine laboratory operated by the Louisiana Wild Life and Fisheries Commission and Fort Livingston on Grand Terre Island. The bay-sound shoreline of Zone IV is relatively undeveloped with only 0.1 mile of public recreation on the western end of Grand Isle (state park); another 0.2 mile on the eastern end occupied by the U. S. Coast Guard Station; 7.4 miles of summer homes and camps on Grand Isle and the shore northwest of Caminada Pass; 4.1 miles of development associated with the oil and fishing industries at Grand Isle; and the Louisiana Wild Life and Fisheries Commission laboratory on Grand Terre Island. The Wisner Wildlife Management Area includes 9.6 miles of gulf shoreline between Belle Pass and Caminada Pass and 4.6 miles of the western shore of Caminada Bay.

ZONE V

Zone V is the present Mississippi River Delta. The gulf shoreline of the delta is undeveloped. Development along the bay-sound shoreline consists of 1.5 miles associated with the oil and shipping industries at Burrwood (Southwest Pass) and at Port Eads (South Pass). There is 0.2 mile of docking facilities associated with sport fishing for fueling, water,

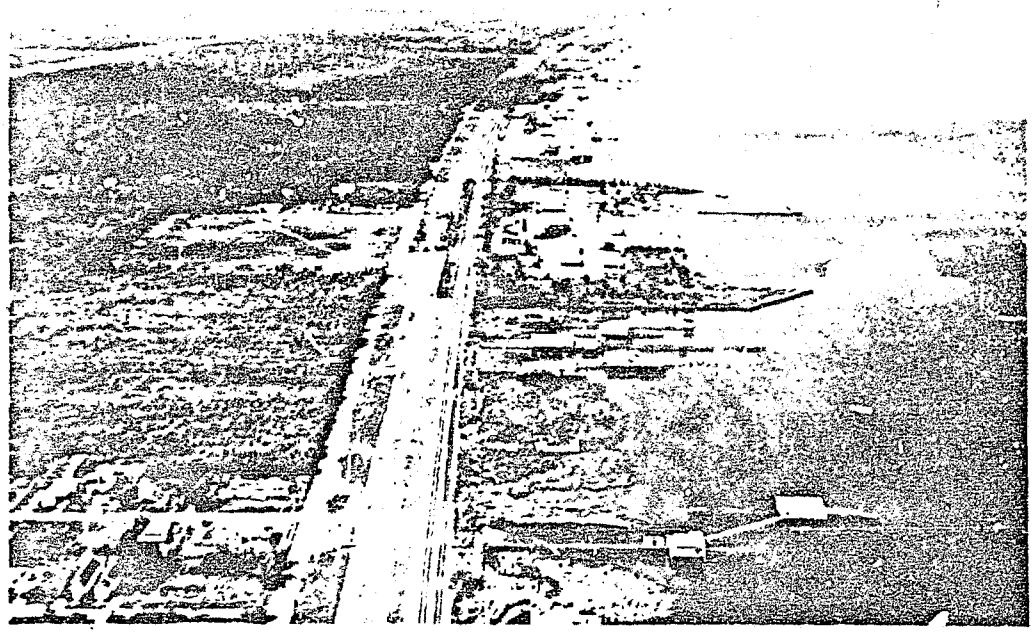
ice, etc., open to the public located along South Pass. A Federally-owned migratory waterfowl refuge and the state Pass a Loutre Game and Fish Preserve and public hunting grounds are located along the east side of the delta. The southern portion of the state-owned Bohemia Wildlife Management Area is also in this zone.

ZONE VI

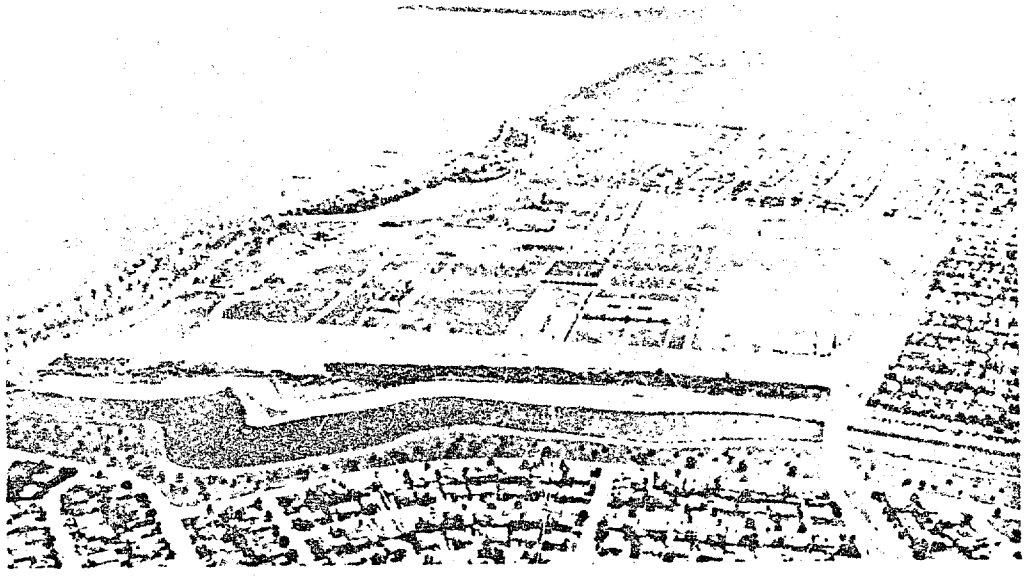
Zone VI consists of the marshlands of the mainland and the offshore Breton Island and Chandeleur Islands. The entire shoreline is undeveloped. Breton Island and the other islands of the Chandeleur chain are a Federal wildlife refuge area and have recently been designated as a wilderness area by the Department of the Interior. The state-managed Bohemia Wildlife Management Area is located east of the Mississippi River and extends to the shore of Breton Sound.

ZONE VII

Zone VII includes a section of the shoreline of the Mississippi Sound and the shorelines of Lake Borgne, Lake St. Catherine, Lake Pontchartrain, and The Rigolets and Chef Menteur Pass. The largest urban area on Lake Pontchartrain is New Orleans, having a 1970 population of about 593,000. All of the 88 miles of the Lake Borgne shoreline and the 25 miles of the Mississippi Sound shoreline are undeveloped. The state-operated Biloxi Wildlife Management Area occupies approximately 14 miles of the Lake Borgne shoreline around Pointe Aux Marchettes. The Venetian Isles subdivision fronts about



Lincoln Beach on New Orleans East Lakefront, August 1970

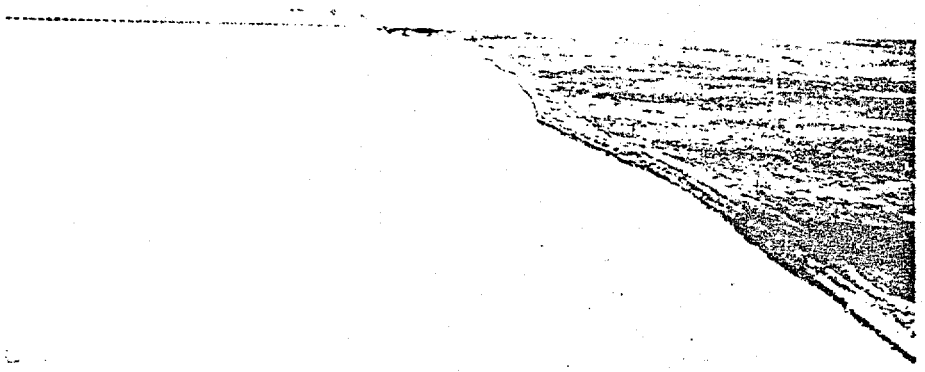


New Orleans Lakeside Park and Pontchartrain Beach with the New Orleans Airport in Background, August 1970

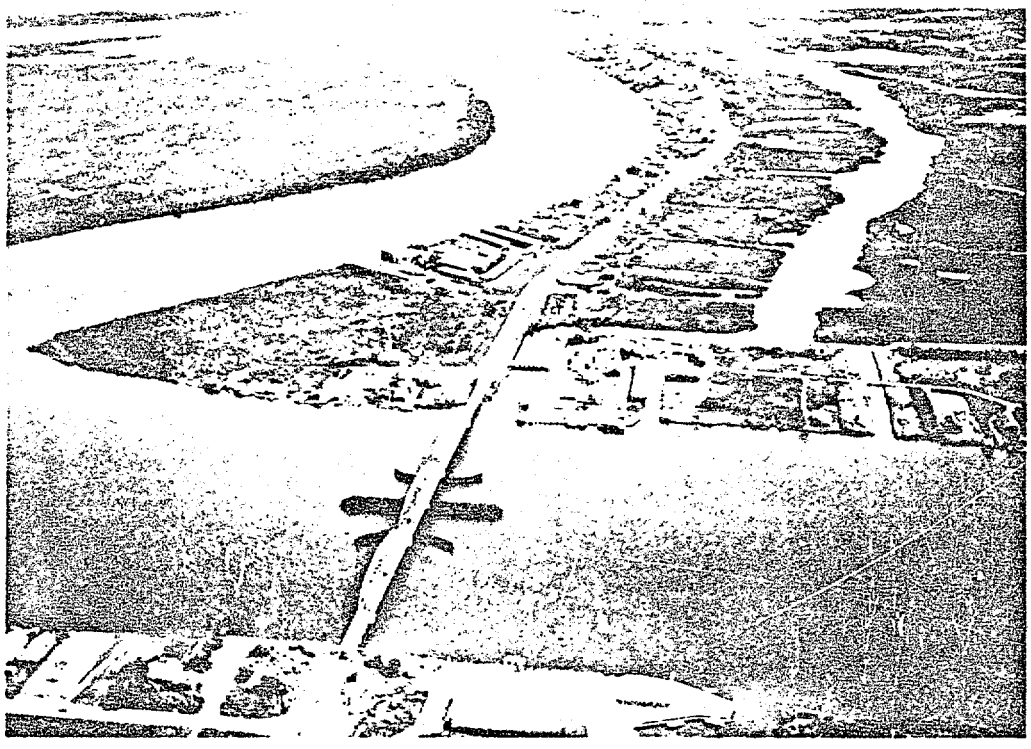
one half mile of the Chef Menteur Pass. Another 2.5 miles of the pass shoreline has hunting and fishing camps. Lake St. Catherine has 18.3 miles of shoreline of which 2.8 miles consist of fishing and hunting camps. The remaining shoreline is undeveloped. Fort Pike State Park fronts about one-tenth of a mile on the shoreline of The Rigolets (see photograph, page 50). Of the 119.0 miles of shoreline around Lake Pontchartrain about 47.2 miles are developed. The city of New Orleans maintains a yacht harbor on the lakefront (lakeward marina, 636). The Orleans Levee District (a state agency) also has extensive developments along Lake Pontchartrain in New Orleans, including a marina (landward marina, 527 berths), a 5.5 mile lakefront park, a 15-lane boat launching ramp and two beaches--Lincoln and Pontchartrain Beaches, which together, are about 4,000 feet in length. Fontainebleau State Park (see photograph, page 51) on the northern shore of Lake Pontchartrain in St. Tammany Parish is one of the largest and most intensely developed recreational areas maintained by the state. It consists of approximately 2,500 acres developed for picnicking, camping, and swimming. Shoreline areas available for public recreation around the lake total about 9.3 miles. Fishing camps are located along approximately 9.5 miles of the shoreline. These camps are at Little Woods, on the northern shore of Lake Pontchartrain south of Slidell, and in an area west of U. S. Highway 90 south of The Rigolets. Other developed areas along the lakefront include railroad tracks at Little Woods and on the western side of the lake north of the Bonnet Carre Floodway (see photograph, page 50), levees along the shorelines of St. Tammany and Jefferson Parishes, a concrete plant east of Lewisburg, a seawall at Mandeville (see photograph, page 48), and permanent residences on the northern shore at Big Point and Treasure Isle. The

New Orleans Lakeside Park and Marinas, August 1970

Big Point, on North Shore of Lake Pontchartrain, August 1970



Levee Along St. Tammany Parish Shoreline of Lake Pontchartrain, August 1970



Recreational Development on Chef Menteur Pass, August 1970

state-owned game preserve on the northern shore in St. Tammany Parish abuts approximately 7 miles of shoreline and the state management area in the Bonnet Carré Floodway fronts approximately 2.2 miles of the lake.

FUTURE DEVELOPMENT

GENERAL

Projections indicate that the population of the Louisiana coastal parishes should reach about 2,700,000 by the year 2020, approximately 1.7 times the 1970 population.

PERMANENT RESIDENTIAL DEVELOPMENT

Future permanent residential development, based primarily on population growth, accessibility, and type of shoreline should occur in Zone VII (Lake Pontchartrain area) as additional lands are leveed or developed as waterfront homesite subdivisions, such as that on the northern shore of Lake Pontchartrain (see photograph, page 27). For the most part, the shoreline areas of Zones I through VI are not suitable for extensive additional permanent residential type development.

INDUSTRIAL DEVELOPMENT

Future industrial development along the shorelines of Louisiana will consist mainly

of that associated with the petroleum, natural gas, and fishing industries. These industries will occupy only a minor amount of the presently undeveloped shoreline area.

RECREATIONAL DEVELOPMENT

An outdoor recreational survey conducted in 1968 indicated that swimming, both pool and beach, was the most popular summer recreational activity in the state. The present supply of pools and beaches will accommodate only 22 percent of the projected estimate of Louisiana's swimmers in 1985. Water-based activities which include saltwater fishing, crabbing, boating, sailing, and water skiing, are also very popular. The situation in the coastal area follows closely the overall situation throughout the state. It is anticipated that accessible shore areas suitable for recreational use and construction of summer homes and fishing camps will be fully utilized in the future.

LITTORAL DRIFT

DIRECTION

The predominate littoral currents in the Gulf of Mexico offshore of Louisiana are from east to west. The littoral currents at the shoreline also are from east to west except in the vicinity of Grand Isle (Zone VI, Belle Pass to vicinity of Quatre Bayou Pass) where the reverse conditions exist. This reversal is particularly noticeable at Caminada Pass and at the stone jetty on the eastern edge of Grand Isle (see photographs, pages 46 and 48). The littoral current along the shoreline of Lake Pontchartrain varies with wind directions and tides. Additional studies would be necessary to determine their direction.

VOLUME

The shorelines of coastal Louisiana are very easily eroded by wave action. The littoral drift in vicinity of Holly Beach (Zone I) has been estimated in a recent study at between 60,000 and 100,000 cubic yards per year. The accumulation of deposits along the west side of the stone jetty at the eastern end of Grand Isle has exceeded 200,000 cubic yards per year in the 3 years following its 1,700-foot extension. No estimate of the amount of sediment passing around or through this jetty or at other locations along the Louisiana shoreline is available.

SEDIMENTS

The only locations where any appreciable amounts of sediment reach the shoreline, other than from local erosion, are at the distributaries of the Mississippi River, Atchafalaya River, and Wax Lake Outlet. The average annual volume of sediments carried by the Mississippi River at the Head of Passes is estimated to be 200 million cubic yards (period of record 1938 to date). The average annual volumes of sediments in the Atchafalaya River at Morgan City and Wax Lake Outlet are estimated to be 42 million and 16 million cubic yards, respectively (period of record 1965 to date).

Section III

SHORE HISTORY

GEOLOGIC HISTORY

GENERAL

For this study, only the geologic history since the end of the Pleistocene (glacial) Epoch need be considered. At that time sea level was about 450 feet below its present level and the Louisiana shoreline was located far to the south of its present position. As glacial retreat began and sea level commenced to rise, streams in the area, including the Mississippi, Vermilion, Mermentau, and Sabine Rivers, began to fill their entrenched valleys with sediments. Initially, coarse material was deposited in the entrenchments, but as sea level continued to rise and stream gradients decreased, finer sediments were deposited over the area. Approximately 4,800 to 5,000 years ago, sea level approached its present level. At that time, the Pontchartrain embayment was at its maximum extent in the deltaic region of Louisiana and extended from Vermilion Bay to the Pearl River. The central and southeastern Louisiana shoreline extended as far inland as Donaldsonville, Louisiana, closely followed the southern margin of the Pleistocene Terrace northeast, north and northwest of New Orleans, and then roughly paralled a line between Baton Rouge and Franklin, Louisiana. From Vermilion Bay to Sabine Pass, the gulf shoreline was close to the inner margin of the present cheniere plain.

THE MISSISSIPPI RIVER

Approximately 4,000 to 5,000 years during the Sale-Cypremort Stage, the Mississippi River began actively depositing sediments in the Iberia and St. Mary area. Two remnant distributaries of this stage, Bayous Sale and Cypremort along the central Louisiana shoreline in Zone II, are distinguishable in the marshlands. While occupying this course, the Mississippi River deposited large quantities of fine-grained sediment. Some of the sediments were transported westward by longshore currents and deposited beyond the limits of the delta proper as mudflats along the Vermilion and eastern Cameron Parish coastline. As the mudflats grew, marsh vegetation began to develop and the process of coastal buildup was initiated. Concurrent with this rapid deposition by the Mississippi River, minor sedimentation occurred as a result of deposition by the Vermilion, Mermentau, Calcasieu, and Sabine Rivers.

About 4,000 years ago, the Mississippi River shifted from the Sale-Cypremort course and began building a delta in the vicinity of Lake Pontchartrain. This has been referred to as the Cocodrie Delta. With a shift in deltaic deposition from central to southeastern Louisiana, compaction and regional subsidence became the dominant processes along the western coast of Louisiana. As a result of wave attack, beach deposits began to accumulate and the initial stage of cheniere development began.

Approximately 3,500 to 3,800 years ago, the Mississippi River shifted its course

westward to the Teche course. Granular material was once again deposited in vast quantities along the central Louisiana shoreline, and the delta began advancing seaward in the area of Terrebonne Parish. As during the Sale-Cypremort Stage, westward prevailing longshore currents carried some materials toward the western shoreline of Louisiana and deposited them as mudflats along the shoreline, stranding beaches and creating chenieres. While general coastal buildup was occurring in central and western Louisiana during the Teche Stage, general deterioration of the Cocodrie Deltaic mass was occurring in the vicinity of Lake Pontchartrain and southeastern Louisiana.

Approximately 2,800 years ago the Mississippi River again shifted eastward to occupy the St. Bernard course in southeastern Louisiana ending coastal buildup in central and western Louisiana. With a marked decrease in the amount of sediments being supplied into the area, portions of the Teche Delta lobe were subjected to subsidence and wave attack, and erosion and subsequent shoreline retreat became the dominant processes in central and western Louisiana. While occupying the St. Bernard course, the Mississippi River developed a vast delta extending from the general vicinity of Barataria Bay out into the gulf beyond the present position of the Chandeleur Island group.

Approximately 1,200 years ago, the Mississippi River shifted westward again, the Lafourche delta began building with this new influx of sediment, and the shoreline in the vicinity of Lafourche and Terrebonne Parishes advanced seaward. Vast quantities of sediment were transported westward by longshore currents to be deposited on the western shoreline of Louisiana developing the cheniere trend consisting of the front ridge of Pecan Island, Belle Isle, and the back ridges of Cheniere au Tigre. Deterioration of the abandoned St. Bernard delta occurred concurrently with the buildup of the Lafourche delta. The Breton and Chandeleur Island groups represent a late stage in deltaic destruction resulting from subsidence behind the old shoreline and reworking of the ends of numerous old distributaries.

Approximately 600 years ago, the Mississippi River abandoned the Lafourche course in favor of its present course to the Gulf of Mexico. The present delta began building into deep water to form the existing birdfoot delta about 400 years ago. With this final eastward shift of the Mississippi River, a deficiency of sediments along the central and western Louisiana coast resulted in coastal retreat and the formation of the cheniere complex in Vermilion Parish.

Within the last 50 years, the Atchafalaya River, main distributary of the Mississippi River above Head of Passes, has increased in size. The discharge of Mississippi River waters down the Atchafalaya River has increased from about 10 percent to a little over 30 percent. The coarser sands and silts transported by the Atchafalaya River are being deposited in the numerous lakes and bays along the river's route and in Atchafalaya Bay. The extremely fine sediments do not settle out in the bay but are carried in suspension to the gulf side of the reef where they settle out as a gelatin-like mass. The prevailing westerly longshore currents carry this flocculated, gelatin-like mass in suspension, and have gradually blanketed the adjacent western Louisiana coast for a distance of about 30 miles west

of Cheniere au Tigre, and have accumulated just offshore to a point at least 10 miles west of the Cameron-Vermilion Parish line. As the basins and lakes along the Atchafalaya River and in its lower reaches become filled, a progressively larger volume of sediment, including the coarser sands and silts will be carried into Atchafalaya Bay.

HISTORICAL SHORE CHANGES

NATURE OF EROSION

GENERAL

The shoreline of Louisiana consists almost entirely of low-lying marshes fronted either by sand beaches, shell beaches, or mud flats. For many years after the Mississippi River occupied its present locations, floodwaters and sediments were widely dispersed in the marsh and coastal area by overbank flow and through many distributary channels such as the Atchafalaya River, Bayou Lafourche, Bayou Barataria, Bayou Terre aux Boeufs, and Bayou La Loutre. The distributary channels, except for those of the Atchafalaya and Mississippi Rivers, have been closed by natural processes and flood control improvements. The overbank floodflows of the Mississippi and Atchafalaya Rivers have been confined by levee construction. The only points along the Louisiana shoreline now receiving appreciable sediments from the inland areas are the present Mississippi River Delta and the Atchafalaya Bay area. The amount of sediments received at these points varies with river stages. Normally there is a slow rise in river stages beginning about December to a flood peak and a gradual fall until July or August followed by a low-flow period extending to December. Peak stage, duration, and the annual flood discharge vary greatly from year to year. The amount of sediments carried to the coastal area varies generally with the volume of floodflow. Most of the sediments from the Mississippi River are deposited in deep water along the edge of the continental shelf.

TIDES

The normal tidal range in the central gulf area is 1.5 feet. Hurricanes, which occur frequently in the gulf during the summer and fall months, raise stages at the shoreline as much as 15 feet or more.

FACTORS CAUSING EROSION

Erosion now taking place along the Louisiana shoreline is the result of normal wind waves, tidal action, and storm waves. The amount of erosion and/or accretion varies greatly along the shoreline.

COASTAL MARSH

The Louisiana coastal marsh has a very high content of organic material resulting from decayed vegetation. In most areas the aggradation from additional vegetation and sediments is not sufficient to offset consolidation of previously deposited materials and subsidence takes place. The average subsidence in the Louisiana coastal marsh is estimated at about 0.4 foot per century. Due to the very low elevation of the marsh (sea level

to 1 or 2 feet), any subsidence increases its vulnerability to wave attack. It is probable that many of the existing inland bays and sounds in the Louisiana coastal area were the result of this type marsh deterioration. Any loss of barrier islands now extending along this part of the coastal area will increase the exposure of the inland marsh to wave attack.

EXTENT OF EROSION

GENERAL

Except for the Mississippi River Delta area practically all of the Louisiana shoreline inventoried for this report is in retreat. The locations at which the shoreline is stable (about 19 miles) or accreting (about 340 miles) are shown in green on plates 2B through 10B. The areas in which buildup is taking place are east of Sabine Pass; east of Calcasieu Pass, in vicinity of Freshwater Bayou; the eastern end of Grand Isle; and a part of the Mississippi River Delta shoreline. The seawall along a part of the New Orleans lakefront and at Mandeville, and levee wave-wash protection along the Jefferson Parish lakefront have stabilized the shoreline in those areas. Areas of maximum erosion are the gulf coastline of Isle Dernieres and Timbalier Islands. The shoreline erosion by zones is discussed in subsequent subparagraphs.

ZONE I

In Zone I, accretion averaging about 11 feet per year (ft/yr) and 8 ft/yr occurred between 1812 and 1954 at the mouths of Sabine and Calcasieu Passes, respectively. Not all of this accretion is due to natural processes. Some can be attributed to the construction of jetties which trap littoral drift at the gulf terminus of these passes. Between the passes, in the general vicinity of Holly Beach, retreat of the magnitude of 3.5 ft/yr has been occurring since 1933. East of Calcasieu Pass to the vicinity of the Mermentau River, accretion is occurring at the present time. The shoreline between the Mermentau River and a point about 25 miles west of Southwest Pass to Vermilion Bay has eroded at an average rate of about 18 ft/yr during the period of 1812-1954. In the reach from the Cameron-Vermilion Parish line for about 10 miles eastward, the shoreline has retreated about 4,000 feet in the last 150 years. In the reach from 23 miles west of Southwest Pass to a point about 17 miles eastward, the shoreline is either stable or accreting. The maximum accretion in the last 24 years was about 1,500 feet. The next 8 miles eastward are eroding. The eastern shoreline of Sabine Lake and the entire perimeter of Calcasieu Lake are retreating.

ZONE II

The entire shoreline in Zone II is in a state of retreat. The average loss during the period 1912-1954 is about 7.5 ft/yr along the gulf shoreline from Southwest Pass to Point au Fer Island. The maximum loss of approximately 1,300 feet occurred near Southwest Pass. In the bay-sound area, most of the shorelines (Vermilion, West and East Cote Blanche, Atchafalaya, and Fourleague Bays) are retreating at varying rates depending upon the shoreline material, exposure, and the amounts of sediment contributed by the

Atchafalaya River. Marsh Island and the submerged shell reefs from Marsh Island to Point au Fer serve as partial barriers or buffer zones between the mainland and the Gulf of Mexico.

ZONE III

Based on shoreline changes between 1812 and 1954, the shoreline in this zone is retreating at about 9 ft/yr.

ZONE IV

The shorelines of this zone are retreating at various rates. Between 1890 and 1959, the shoreline recession of Isle Dernieres was about 800 feet at the western end, 2,500 feet in the central section, and 1,600 feet towards the eastern end (an average of about 25-30 ft/yr). During the same period, lateral gains were experienced on the order of 50 ft/yr and 25 ft/yr at the western and eastern ends, respectively. The Timbalier Island chain has experienced very complex changes between 1890 and 1959. The eastern end of Timbalier Island has receded approximately 2,500 feet. The center has experienced no movement. The western end has gained in volume and area, as the island is being extended westward at the rate of about 290 ft/yr along a line parallel to the shore. The eastern end of East Timbalier Island has receded approximately 7,500 feet. This area is eroding but at the same time, it is filling the gaps between the island and the mainland thus forming a continuous spit. The western end of East Timbalier has receded approximately 5,000 feet (1890-1959) but is extending parallel to the long axis of the island by approximately 170 ft/yr (1890-1959). The northern shore of the island is moving towards the mainland indicating a landward migration of the island. A retreat at the rate of about 62 ft/yr (1812-1954) has been experienced from East Timbalier Island to Caminada Pass. The maximum regression of 6,650 feet occurred between 1890 and 1959 in the vicinity of Belle Pass. From Caminada Pass to Sandy Point at the eastern extremity of Zone IV, the shoreline retreat has been averaging between 15 and 25 ft/yr (1812-1954). Between 1853 and 1935, a recession of about 1,500 feet occurred at the western end of Grand Isle. The recession was equaled by the advance of approximately the same amount at the eastern end of the island. Between 1935 and 1955, the 6,000 feet of shoreline at the western end of the island advanced about 1,000 feet gulfward. Erosion, varying from 100 to 300 feet near the center of the island to about 500 feet at the eastern end, occurred east of this area. The western end of Grand Isle is in a cyclic state of accretion and erosion. The construction of 1,000 feet of jetty at the eastern end of Grand Isle in 1959 and an extension of 1,700 feet in 1965 have resulted in accretion west of the jetty.

ZONE V

The most complex changes along the entire Louisiana shoreline are occurring in Zone V. The general overall pattern is one of advancement with gains of as much as 100 to 200 ft/yr occurring at the mouths of the various passes, and gains of as much as 300 ft/yr taking place in the intervening areas between the passes during the past 140 years. However, this pattern is complicated by the fact that some passes exhibit very little accretion and some zones between the passes, notably west of Southwest Pass and

between Southwest and South Passes, are retreating.

ZONE VI

Between 1812 and 1954, the Breton and Chandeleur Islands are retreated westward at about 13.7 ft/yr. The Chandeleur Islands proper are retreating as much as 25 ft/yr. Between 1807 and 1939, the land area in Zone VI has been reduced from about 721 square miles to about 617 square miles. This reduction in land area is the result of landward retreat of the shoreline, and enlargement of the lakes, ponds, and bays within the marshlands resulting from subsidence and wave attack.

ZONE VII

Zone VII, including Lakes Borgne and Pontchartrain, based on various years of record for different locations, experienced shoreline retreat averaging 4.5 ft/yr in Lake Borgne and 5.4 ft/yr in Lake Pontchartrain. The areas of maximum shoreline retreat are in the vicinity of Frenier on the western shore and at Point aux Herbes on the eastern shore. Minimal retreat of 0.3 to 3 4 ft/yr has been experienced along the northern shore of the lake between Mandeville and The Rigolets except at Goose Point where erosion of about 10.9 ft/yr is occurring. The southern shore of Lake Pontchartrain has been stabilized by a concrete seawall and levee system from the New Orleans Airport to the Jefferson-St. Charles Parish line.

CRITICALLY ERODING AREAS

GENERAL

In this report areas undergoing significant erosion were categorized critical if the rate of erosion, considered in conjunction with economic, industrial, recreational, agricultural, navigational, population trend, ecological, and other relevant factors, indicated that action to halt erosion may be or become justified. Areas undergoing significant erosion were categorized noncritical if consideration of these factors indicated that management to prevent or minimize adverse effects may be more appropriate than action to halt erosion.

COASTAL AREA

The Louisiana coastal area and adjacent gulf waters abound in mineral production. The lakes, bays, and streams in the Louisiana coastal area are an extremely valuable nursery area supporting a very large fishery in the Gulf of Mexico and coastal waters. Because of their importance to the fishery production (shrimp, oysters, menhaden, crabs, and commercial and sport fish) the preservation of the estuarine areas is a matter of concern.

LOCATION

Areas of critical shore erosion, noncritical shore erosion, and noneroding shore are shown on plates 2B through 10B. Locations of critical erosion, as defined above, are at Grand Isle and Fort Livingston in Zone IV and Fort Pike, St. Charles Parish levee, Orleans Parish levee, Illinois Central Railroad traversing the St. John the Baptist Parish shoreline, Mandeville, and Fontainebleau State Park Beach in Zone VII.

Section IV
AUTHORIZED FEDERAL PROJECTS

GENERAL

There are no authorized Federal beach erosion control projects in Louisiana. Authorized Corps of Engineers navigation, flood control, and hurricane protection projects that extend through or into the shoreline study area are summarized below. Improvements completed, underway or not yet started under these authorizations will influence the Louisiana shoreline. General information on these improvements is shown below. More detailed information is available in the "Water Resources Development in Louisiana."

NAVIGATION PROJECTS

Navigation projects in the shoreline study area consist of ship channels in the Sabine, Calcasieu, and Mississippi Rivers and the Mississippi River-Gulf Outlet and numerous barge channels well distributed over the Louisiana shoreline. These projects are:

SABINE-NECHES WATERWAY

Sabine-Neches Waterway, Louisiana and Texas, provides for an approach channel 42 feet deep and 800 feet wide in the gulf, 40 feet deep and 500 to 800 feet wide through the jetty channel, 40 feet deep with varying widths to Port Arthur and Beaumont via the Neches River, 30 feet deep with varying widths to Orange via the Sabine River, rubble mound jetties at the Sabine Pass, and other improvements not pertinent to the Louisiana shoreline area. The lengths of the east and west jetties are 25,310 feet and 21,905 feet, respectively.

CALCASIEU RIVER AND PASS

This project provides for a 42- by 800-foot approach channel in the Gulf of Mexico, a 400-foot wide jetty channel varying in depth from 42 feet at the outer end to 40 feet at the shoreline, a 40- by 400-foot channel in Calcasieu River to Lake Charles, jetties to the 15-foot depth contour, maintenance of a barge channel 12 by 200 feet from the ship channel to Cameron, and other improvements upstream of Lake Charles. The jetties have been completed to the 12-foot depth contour. Extension of the jetties is not contemplated at this time. All other work described above has been completed.

MISSISSIPPI RIVER, BATON ROUGE TO THE GULF OF MEXICO

This project provides for a 40-foot deep channel in the Mississippi River and Southwest Pass from the Gulf of Mexico to Baton Rouge with widths of 600 feet through the bar channel, 800 feet in Southwest Pass, 1,000 feet from the Head of Passes to the Port

of New Orleans, and 500 feet through the Port of New Orleans and to Baton Rouge; and a 30-foot deep channel in South Pass with widths of 600 feet through the bar channel, and 450 feet in the pass. In the development and maintenance of the authorized dimensions, Southwest Pass has been constricted by pile dikes and controlled outlets constructed through the banks at numerous locations. Jetties were constructed at the mouths of South and Southwest Passes. Pile dikes have also been constructed at the Head of Passes to aid in distribution of flow and reduce maintenance costs. The work is essentially complete.

MISSISSIPPI RIVER-GULF OUTLET

This project provides for a 36- by 500-foot channel from the Inner Harbor Navigation Canal in New Orleans to the Gulf of Mexico, jetties for the reduction of shoaling, a turning basin, and a lock and connecting channel with the Mississippi River. The main channel and turning basin have been completed.

Mississippi River-Gulf Outlet, February 1970

BARGE CHANNELS

The many barge navigation channels passing through the shoreline under study, their size and status are shown in table 2 on pages 56 and 57. Jetties have been constructed at the channel entrances into the Gulf of Mexico at Bayou Lafourche (Belle Pass) and at the waterway from Empire to the gulf (see photographs, page 11). Under a permit from the Department of the Army, non-Federal interests have constructed and are

maintaining a large channel from Bayou Lafourche to the gulf and have closed the jetty [illegible]. The jetties at the waterway from Empire to the gulf have been completed to the 9-foot depth contour. Extension of the jetties to the 9-foot depth contour is authorized when justified by reduction in maintenance costs. Jetties also are authorized at the entrances of the Freshwater Bayou Channel and the Mississippi River Outlets in vicinity of Venice (Tiger Pass on the west and Baptiste Collette Bayou on the east) if and when justified. The necessity for these jetties cannot be evaluated until after several years of maintenance.

FLOOD CONTROL PROJECTS

Flood control projects of importance to the Louisiana shoreline area are the Flood Control Mississippi River and Tributaries and Lake Pontchartrain, Louisiana and Vicinity projects. These projects either affect the distribution and flow of sediments into the coastal zone or provide for improvements that will modify the erosion rate of the shoreline. These projects and their features of importance to the coastal area are described in subsequent paragraphs.

FLOOD CONTROL, MISSISSIPPI RIVER AND TRIBUTARIES

This project provides for the control of floods on the lower Mississippi River by a system of levees, floodways, channel improvements, and bank stabilization. The plan provides for the distribution of the design flow of the Mississippi and Red Rivers (approximately 3,000,000 cubic feet per second [cfs]) equally between the Mississippi River and the Atchafalaya Basin. Diversion from the Mississippi River would be made at Old River (620,000 cfs), the Morganza Floodway (600,000 cfs), the West Atchafalaya Floodway (250,000 cfs), and Bonnet Carré Floodway (250,000 cfs). The construction of levees prior to and under this project and the modified distribution of floodwaters has substantially altered the distribution of sediments along the shoreline. Further changes will occur as lakes in the Atchafalaya Basin are filled with sediments and new diversions are made from the Mississippi River. Features of this project of particular importance of the shoreline area are:

COMPLETED PROJECTS

East bank of Mississippi River. *The east bank Mississippi River levee* is continuous from high ground in Baton Rouge to just below Pointe a la Hache (about 44 miles above the Head of Passes (AHP) of the river) except for controlled openings at the Bonnet Carré Spillway and the Inner Harbor Navigation Canal Lock in New Orleans. An overbank spillway (the Pointe a la Hache Relief Outlet), extending about 4.5 miles downriver from the end of the levee and from the river to Breton Sound and its tributaries, has been acquired and maintained by the Orleans Levee District (a state agency) for discharge of a part of the river floodwaters. Non-Federal interests have constructed levees along the east bank of the river in some areas downstream of the relief outlet.

Bonnet Carré Floodway. This floodway, located about 25 miles upriver from New Orleans, is designed to divert 250,000 cfs of the Mississippi River design flood to Lake Pontchartrain and together with other floodways prevents the river stage at New Orleans from exceeding 20 feet. It consists of a reinforced concrete control structure with removable timber needles, guide levees along each side, and high level crossings for railroads and highways. It has been operated in 1937, 1945, and 1950. The floodwaters diverted through the spillway deposit most of their sediments in the floodway or soon after reaching Lake Pontchartrain. The diverted floodwaters also reduce salinities in Lake Pontchartrain, Lake Borgne, and other coastal Louisiana areas east of the Mississippi River.

The west bank of Mississippi River. *The west bank levee* is continuous from the Arkansas River to Venice, Louisiana (about mile 10 AHP), except for controlled openings at Old River (gated reinforced concrete control structures at mile 315 AHP and a lock at mile 304 AHP), Morganza Floodway (gated reinforced concrete control structure at mile 280 AHP), Port Allen Lock at mile 228.5 AHP, Plaquemine Lock at mile 208.8 AHP (to be closed by an earth levee in 1972), Harvey Lock at mile 98.3 AHP, Algiers Lock at mile 88.3 AHP, and Empire Lock (state-owned) at mile 29.5 AHP.

The Atchafalaya Basin Floodway is about 10 miles wide and has a design capacity of 1,500 cfs. It receives the flows of the Atchafalaya River, Morganza Floodway, and West Atchafalaya Floodway and discharges the flows into Atchafalaya Bay through the lower Atchafalaya River and the Wax Lake Outlet. The confining levees include floodwalls at Morgan City and Berwick. Other improvements include an intercepted drainage channel along the west side of the floodway in levee borrow pits and natural channels and an outlet channel (Charenton Drainage Canal) to West Cote Blanche Bay; a central floodflow channel from the Atchafalaya River to the lower Atchafalaya River; roads on the levees; and freshwater distribution and access channels in the basin.

The removal of the raft in the Atchafalaya River in the late 19th century and subsequent enlargement of the Atchafalaya River by natural processes and dredging have resulted in an increase in flow of both water and sediments into the lower Atchafalaya Basin. Grand and Sixmile Lakes have been almost filled with sediments and a large increase in sedimentation in Berwick Bay has occurred. An increase in flow of sediments into Atchafalaya Bay through both the river and Wax Lake Outlet has occurred and will continue until the bay is filled and a delta formation created offshore of the Point au Fer shell reef.

Wax Lake Outlet was constructed between Sixmile Lake and Atchafalaya Bay to carry a part of the increased floodflows contemplated in the Atchafalaya Basin from diversions through the Morganza and West Atchafalaya Floodways. Its design capacity is 300,000 cfs. Spoil bank levees, with gated control structures at Bayou Teche, have been constructed between Sixmile Lake and the Gulf Intracoastal Waterway to confine the flows.

Charenton Drainage Canal was constructed from the west Atchafalaya Basin protection levee borrow pit to West Cote Blanche Bay to discharge landside drainage intercepted by the floodway levees. It utilizes about 5 miles of Bayou Teche.

The Lake Pontchartrain levee feature consists of a levee to elevation 10.0 feet along the Lake Pontchartrain shoreline of Jefferson Parish with tie-in levees to a pumping station on the Jefferson-Orleans Parish line and high ground on the Jefferson-St. Charles Parish line with riprap and asphalt paving to protect the levee against wave wash. The improvement was completed in 1965. Subsequent to the completion of the Federal improvement local agencies have raised the levee protection to elevation 14.0 feet by additional earth fill and steel sheet piling.

UNCOMPLETED PROJECTS

Freshwater diversion structures. The construction of the Mississippi River levees below New Orleans has reduced the amount of freshwater entering the marsh in the Breton Sound and Barataria Bay areas. To restore the freshwater flow for the benefit of the fishery, four freshwater diversion structures in the Mississippi River levees below New Orleans and outlet channels have been authorized. These structures are to be designed in cooperation with the U. S. Fish and Wildlife Service and the Louisiana Wild Life and Fisheries Commission. Non-Federal interests are to bear half the cost of construction and to operate the structures after completion. Local interests have requested that the Bohemia Structure in the east bank at about mile 39 above the Head of Passes be constructed first so that its operation can be observed before design of the other structures is initiated. The other three structures are to be located at about mile 82 above the Head of Passes in the east bank levee and at about miles 37 and 60 above Head of Passes in the west bank levee. Design of the Bohemia Structure is underway.

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY

This hurricane protection project consists of two independent protective plans, the Lake Pontchartrain Barrier Plan and the Chalmette Area Plan. The major features of each plan are described below:

LAKE PONTCHARTRAIN BARRIER PLAN

Barrier. This feature of the plan consists essentially of a barrier across the eastern end of Lake Pontchartrain to limit hurricane-generated tidal surges from entering the lake from the Gulf of Mexico. This barrier is comprised of a lock and a control structure at the Lake Pontchartrain end of the Inner Harbor Navigation Canal, navigation and flood control structures at Chef Menteur Pass and The Rigolets, and adjoining barrier levees which, in conjunction with the U. S. Highway 90 embankment, will form a continuous line of protection from eastern Orleans Parish to St. Tammany Parish, southwest of Slidell, Louisiana. By coordinated operation of the barrier structures, the hurricane tide levels in Lake Pontchartrain can be restricted to low stages, assuring a high degree of protection against flooding to developed areas around the lake and reducing levee grade requirements for land areas around the lake. Hydraulic studies have indicated that under some severe conditions, the structures and embankments may be overtopped by waves. The volume of inflow caused by the overtopping will not significantly alter lake levels. Detailed design work for the barrier structures is underway.

Orleans Parish levees. This feature provides for construction and/or improvement of the levees and floodwalls along the Orleans Parish lakefront, the Inner Harbor Navigation Canal, and the north side of the Gulf Intracoastal Waterway and Mississippi River-Gulf Outlet in Orleans Parish. Planning and/or construction is underway.

Seabrook Lock. In addition to serving as part of the barrier described above, the Seabrook Lock will also serve to control high current velocities in the Inner Harbor Navigation Canal, provide flood stage relief to industries in the Inner Harbor Navigation Canal, assure riparian user daily flow requirements, and limit saltwater intrusion into the lake. This complex of structures is currently in the detailed design stage.

Jefferson Parish levee. The existing lakefront levee was found to be adequate in height with the barrier in place. Riprap protection is authorized, if necessary.

St. Charles Parish levee. This feature provides for a levee with wave-wash protection along the St. Charles Parish lakefront from the St. Charles-Jefferson Parish line to the Bonnet Carré spillway east guide levee. This feature is in the design stage.

Mandeville seawall. This item provides for improvement of the existing seawall in the city of Mandeville in St. Tammany Parish, Louisiana.

CHALMETTE AREA PLAN

This is an independent feature of the project which provides for a ring-type protective system around that part of Orleans and St. Bernard Parishes between the Mississippi River and the Mississippi River-Gulf Outlet. The protective system consists of construction and/or improvement of levees and floodwalls and extends from the Mississippi River to the Mississippi River-Gulf Outlet along the east side of the Inner Harbor Navigation Canal, thence along the south shore of the Mississippi River-Gulf Outlet from the Inner Harbor Navigation Canal to Verret, Louisiana, thence westward to the Mississippi River levee at Caernarvon, Louisiana. The spoil bank from construction of the Mississippi River-Gulf Outlet will be utilized as a base for the levee along the south side of the Mississippi River-Gulf Outlet. Navigation structures will be provided the Mississippi River-Gulf Outlet levee at Bayous Bienvenue and Dupre. Construction is underway on this levee. The navigation structures are in the design stage.

OTHER HURRICANE PROTECTION PROJECTS

Other hurricane protection projects have been authorized to protect areas in vicinity of Morgan City (Morgan City and Vicinity), along Bayou Lafourche from Golden Meadow to the Gulf Intracoastal Waterway (Grand Isle and Vicinity), and along the Mississippi River in Plaquemines Parish (Mississippi River Delta at and below New Orleans also called Mississippi River, New Orleans to Venice). These projects are inland of the shoreline under study and will not alter the shoreline. They will permit safe habitation in areas closer to the Gulf of Mexico and may result in increased utilization of fishing and other recreational opportunities.

Section V

AUTHORIZED FEDERAL SURVEY STUDIES

GENERAL

The New Orleans District, Corps of Engineers, has made beach erosion studies of Belle Pass to Raccoon Point, which include Isle Dernieres and Timbalier Islands and Grand Isle. The filling of Atchafalaya Bay by Atchafalaya River sediments was investigated for a published report. Three survey studies involving the Louisiana shoreline are currently underway. These investigations are described in subsequent paragraphs.

BELLE PASS TO RACCOON POINT, LOUISIANA

Belle Pass to Raccoon Point, Louisiana, is a beach erosion study of the chain of barrier islands along the shoreline of Terrebonne and Lafourche Parishes (plates 5A and 6A) made in cooperation with the Louisiana Department of Public Works. The report, dated 15 December 1960, has been published as House Document No. 338, 87th Congress. The report concluded that the Isle Dernieres chain would provide protection for the mainland for a normal period of 100 years and that the Timbalier chain would have a longer life expectancy; that periodic replenishment of the beaches from offshore bottoms would be relatively expensive; that use of material for replenishment from the bay area would suffice for only a short period of time and would aggravate the problem when the retreating island reached the borrow area; that use of material from distant sources is not reasonable; that use of structures such as groins or breakwaters was not practicable because of poor foundations, limited interception of littoral drift, and the possibility of deleterious action elsewhere in the problem area; and that minimum measures should be taken by local authorities to maintain the integrity of the islands. The minimum measures proposed included the prohibition of removal of materials from the islands or from the near shore gulf or bay bottoms; close supervision of the dredging for navigation channels; and closure of any breaches in the islands caused by storms should they fail to close naturally in a short time. Methods of preserving the island chains were studied. Conclusions presented in the report resulted in the recommendation that no Federal project be adopted at that time.

GRAND ISLE

COMPLETED STUDIES

The most recent report, 2 April 1954, on investigations of beach erosion conditions at Grand Isle was published as House Document No. 132, 84th Congress entitled "Grand Isle, Louisiana Beach Erosion Control Study." The plan proposed for the protection and stabilization of the Grand Isle area consists of direct placement of suitable material to fill the two groin systems and adjacent eroding areas; periodic subsequent replenishment of these stockpiles or placement of material at locations required by shifting of the critical areas of erosion; and construction of a jetty near the eastern end of the island to act

as a barrier to eastward drift and loss of material from the shores off Grand Isle. Recommendations in the report prescribed that any protective measures undertaken by local interests be in accordance with the plans and methods developed in the study. At the time of the study, the shorefront property on Grand Isle was privately owned and under the policy of existing Federal law at that time was ineligible for Federal participation in the cost of protection. Therefore, no Federal project was adopted. A subsequent study of the area for hurricane protection (under Public Law 71, 84th Congress) has been published as House Document No. 184, 89th Congress, entitled "Grand Isle and Vicinity, Louisiana." This report dated 11 July 1963 recommended hurricane protection by construction of a ring levee around the Bayou Lafourche area from Golden Meadow to Larose and concluded that protection of Grand Isle from hurricane tidal overflow was not practicable and that a safe evacuation route (high level highway) and hurricane proof shelters should be provided. The project as authorized provides for Federal participation only in the construction of the ring levee.

STUDIES UNDERWAY

Studies of Grand Isle for beach erosion control, hurricane protection, and related purposes are underway pursuant to resolutions adopted 26 September 1963 and 5 May 1966 by the Committee on Public Works of the House of Representatives, United States.

HOLLY BEACH

Studies of the shores of the Gulf of Mexico in vicinity of Holly Beach for beach erosion control, hurricane protection and related purposes were made in answer to resolutions adopted 4 August 1964 and 3 September 1964 by the Committees on Public Works of the United States Senate and House of Representatives, respectively. This study included the area from Calcasieu River westward to just east of the Sabine River. Protection for the highway and residential development at Holly Beach were evaluated in the study. It is recommended in the report, now under review, that no Federal project be adopted.

LOUISIANA COASTAL AREA

This study is authorized by resolutions adopted 19 April 1967 and 19 October 1967 by the Committees on Public Works of the United States Senate and House of Representatives, respectively. This is a broad study in which several Federal and state agencies are participating. The purposes stated in the authorizing resolutions are hurricane protection, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and related water resources. The scope of this study is adequate to encompass the entire shoreline area of Louisiana. Studies to develop basic data on existing conditions in the coastal area including salinities, vegetation, erosion rates, and fish and wildlife values have been initiated by participating agencies and by the Louisiana Coastal Institute. Studies also involving the Louisiana coastal marsh area, but not the shoreline specifically, are the Old and Atchafalaya Rivers Control study and the West Texas and East New Mexico Water Import study. Each of these studies will involve the waterflow into the shoreline area and thus in some areas the same data will serve all three studies.

Section VI
ADDITIONAL FEDERAL SURVEY STUDIES NEEDED

STUDIES REQUIRED

Beach erosion studies that may be required in the near future could be incorporated in the Louisiana Coastal Area Study now underway (see preceding paragraph).

Section VII
IMPROVEMENT METHODS

GENERAL CONCEPTS

There are many methods of preventing erosion, and detailed studies would be required to determine the best method for each area. Expensive protective structures have been constructed to provide erosion control for some of the highly developed areas, such as the New Orleans shoreline of Lake Pontchartrain. However, most of the shoreline of Louisiana is bordered by undeveloped low-lying marsh, and structural measures are not economically justified. Possible methods that could be used to prevent land loss at these locations are the establishment of a vegetative cover in the area between high and low tides and diversion of the sediment-laden flows of the Mississippi and Atchafalaya Rivers into the shore area. Proper management of the marsh areas, zoning, and other nonstructural methods could also be employed to lessen the detrimental effect caused by erosion of these areas.

TYPE OF REMEDIAL ACTION AND ESTIMATED COSTS

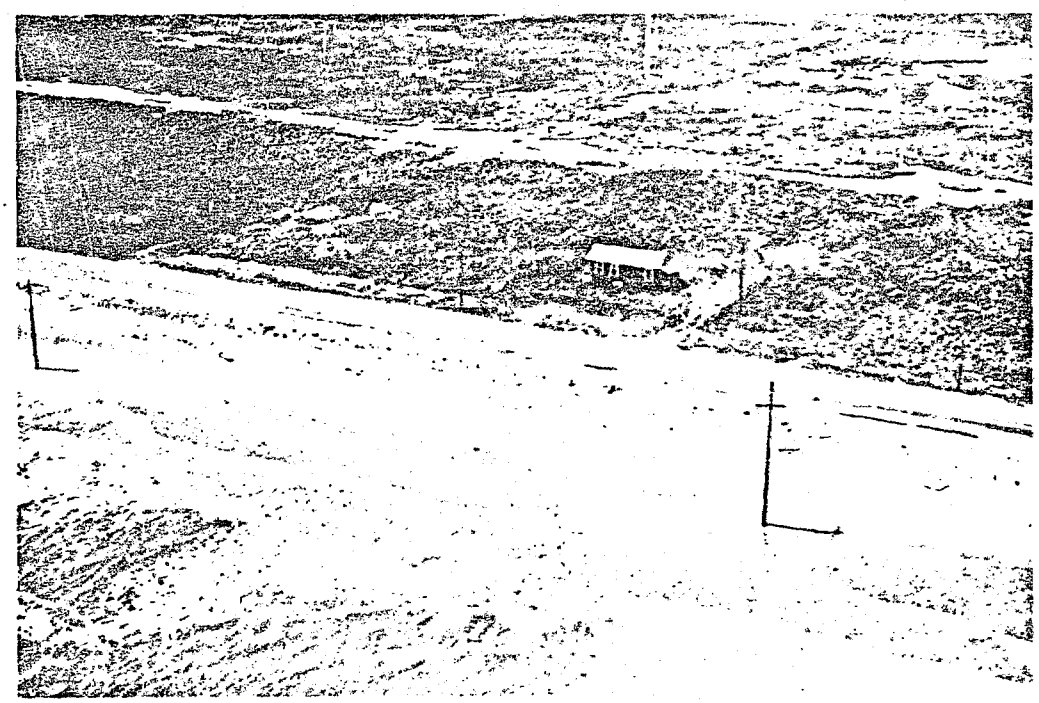
EXISTING IMPROVEMENTS

Existing improvements are listed below by zones. There are no known existing improvements for the prevention of erosion in Zones II, III, V, and VI.

ZONE I

Three miles of revetment were installed in 1970 near Holly Beach, Louisiana, by the Louisiana Department of Highways, to prevent the erosion of the roadbed of Louisiana Highway 82. The revetment consists of cellular concrete blocks on a plastic filter cloth. Initial tests indicate that the revetment remains stable under moderate storm conditions if properly installed. The cost of the revetment was $25 per linear foot. The photographs below show a section of the highway before and after placement of the revetment.

Louisiana Highway 82 Before Revetment Construction, September 1968

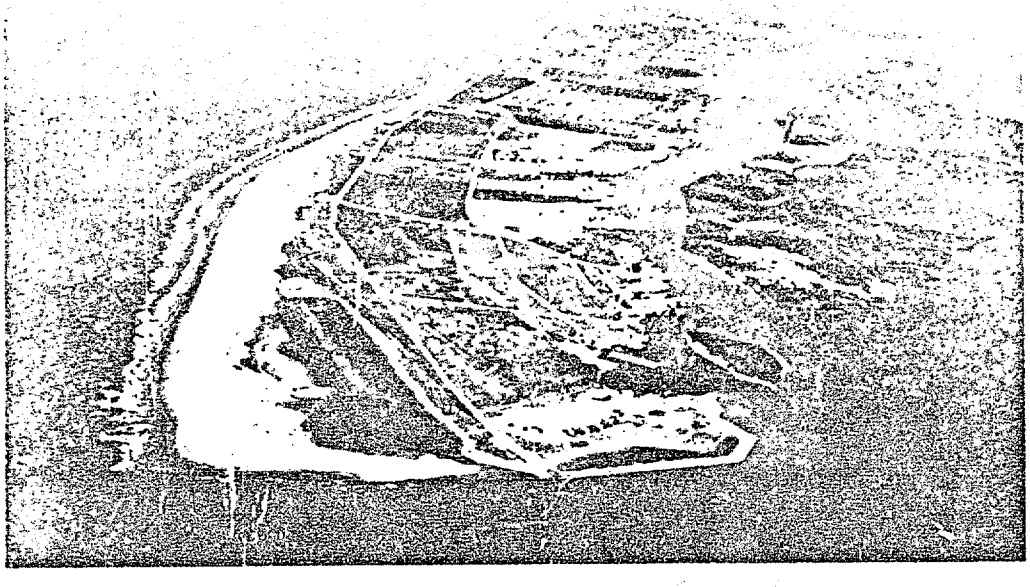


Louisiana Highway 82 After Revetment Construction, May 1971

ZONE IV

Groins and a revetment were constructed along 1 mile of the gulf shoreline of East Timbalier Island by the Gulf Oil Company. Two 350-foot groins of movable concrete segments and stone were constructed in 1966 and a 5,300-foot stone revetment, one 130 foot stone groin, and three 90 foot stone groins were constructed in 1968. Total cost for all work was about $250,000.

Groins, a stone jetty, and a revetment have been constructed and the beach nourished along the gulf shore of Grand Isle. Fourteen creosoted timber groins, 250 to 500 feet in length, were constructed by the Louisiana Department of Highways in 1951 and 1952 at a cost of about $480,000. Periodic nourishment has been required. The beach was nourished by a total of 1,150,000 cubic yards of sandfill during 1954 and 1955 and by 350,000 cubic yards in 1961 and 1962 at costs of about $188,000 and $115,000, respectively. The beach was restored following Hurricane Flossy in 1956 by placement of 140,000 cubic yards of sandfill at a cost of about $76,000 and after Hurricane Betsy in 1965 by placement of 550,000 cubic yards of sandfill at a cost of about $447,000. A 935-foot stone jetty was constructed at the eastern end of Grand Isle in 1958 and 1959 by the Louisiana Department of Public Works at a cost of about $150,000. The jetty was extended to a total length of 2,335 feet in 1964 at a cost of about $200,000. It has trapped large quantities of the littoral drift. A revetment consisting of graded riprap, shell, and a plastic filter was constructed in 1969 at the U. S. Coast Guard Station at the eastern end of Grand Isle at a cost of about $100 per linear foot. Performance of this revetment has been satisfactory to date.



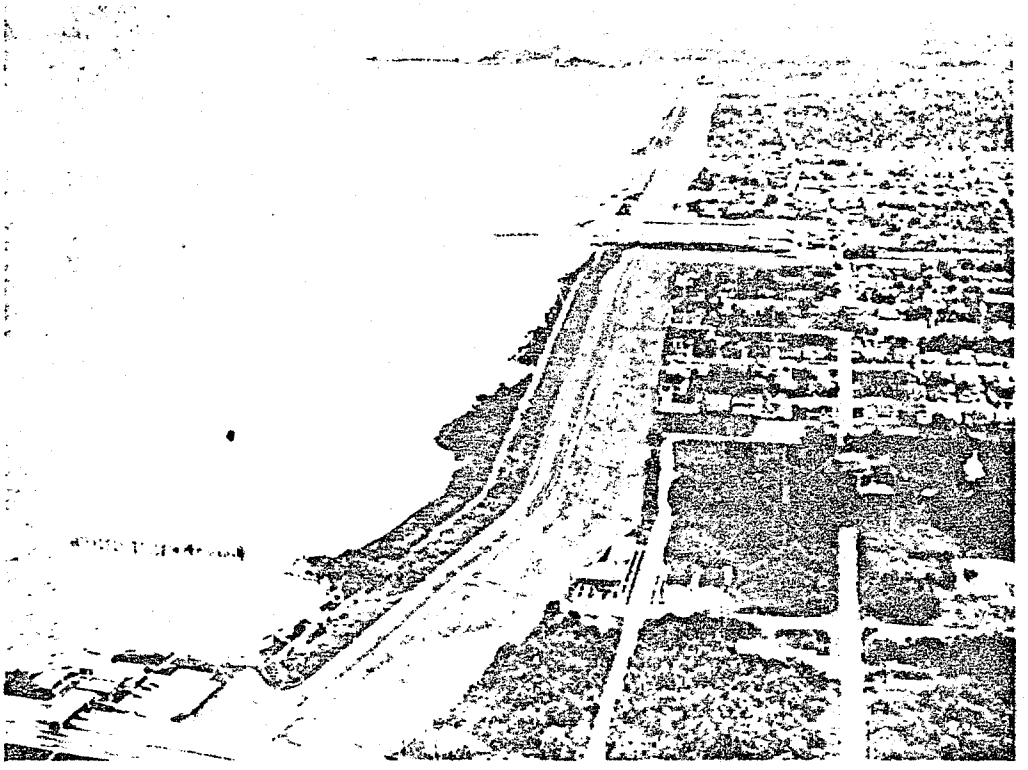
East End of Grand Isle, April 1970

ZONE VII

In order to repair and prevent scour and bank erosion under the approach spans of the U. S. Highway 90 bridge over the Chef Menteur Pass, the Louisiana Department of Highways added five spans to the eastern approach and constructed a bulkhead at the western approach. This work was accomplished in 1961 at a cost of approximately $90,000. Repairs were again made to the eastern approach spans in 1970 at a cost of about $40,000.

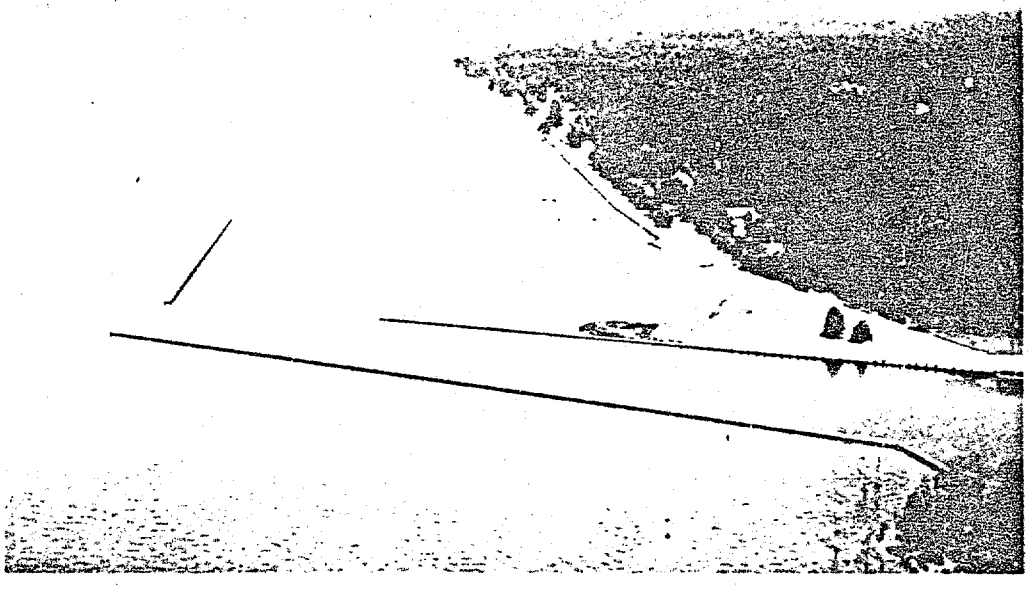
About 8.0 miles of the west Orleans Parish lakefront has been protected from erosion by concrete seawalls. These seawalls include 2.3 miles of vertical wall at the New Orleans Airport, 5.2 miles of reinforced concrete step type seawall from the Inner Harbor Navigation Canal to the small boat harbor (see photograph, page 27), and 0.5 mile of vertical concrete wall between the small boat harbor and Jefferson Parish.

Erosion protection for the entire Jefferson Parish lakefront has been provided by riprap and asphalt pavement wave-wash protection constructed as a part of the Lake Pontchartrain levee.

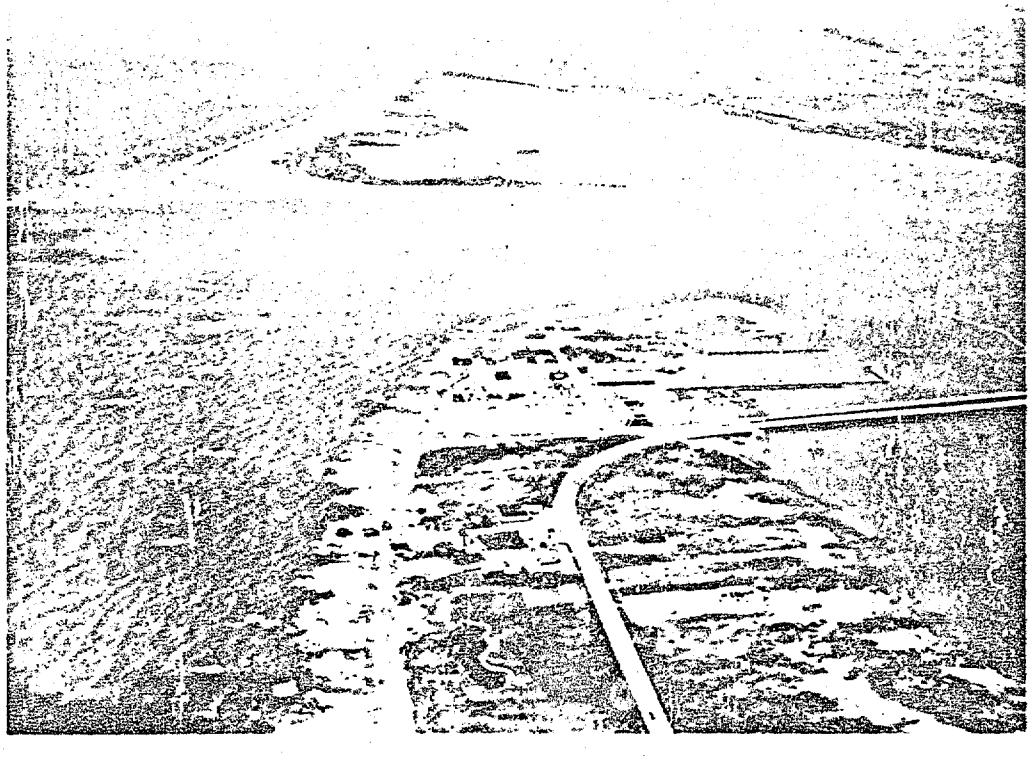


Jefferson Parish Shoreline of Lake Pontchartrain, August 1970

A vertical concrete seawall about 1.5 miles long was constructed in 1915 along the lakefront of the town of Mandeville. About 40 concrete groins 150 to 250 feet in length were added in 1938-1940. A concrete pile breakwater, 760 feet long and about 800 feet lakeward of the eastern end of the seawall, was constructed in 1964. The



Mandeville Seawall on North Shore of Lake Pontchartrain, August 1970



West End of Grand Isle, May 1971

breakwater, together with the concrete jetties constructed at the entrance to Bayou Castine, has trapped and retained a considerable amount of material, some of which were from maintenance dredging of the bayou. The groins have been relatively ineffective in trapping sediments.

AUTHORIZED EROSION PREVENTION IMPROVEMENTS

The Lake Pontchartrain, Louisiana and Vicinity project provides for the construction of levees with necessary wave-wash protection in Orleans and St. Charles Parishes. A levee with wave-wash protection is to be constructed along the lake shoreline in Orleans Parish for about 12 miles east of the New Orleans Airport to replace protection now provided by the railroad embankment. A levee with wave-wash protection also is to be constructed along the St. Charles Parish lakefront from the Jefferson Parish line to the Bonnet Carré Floodway a distance of about 5.7 miles. This project also provides for riprap protection of the seawall at Mandeville.

POSSIBLE ADDITIONAL EROSION PROTECTION

Other areas where the continuance of critical erosion, as defined on page 35, may be expected to endanger property or landmarks of historical significance are discussed in the following paragraphs.

GRAND ISLE

Studies indicate that the most effective method to restore and stabilize the beach at Grand Isle is a plan of widening the beach (200-foot minimum width) by artificial placement of approximately 700,000 cubic yards of sand and periodic nourishment of approximately 40,000 cubic yards annually. Stabilization of the western end of the island would require construction of a jetty at Caminada Pass.

FORT LIVINGSTON AND FORT PIKE

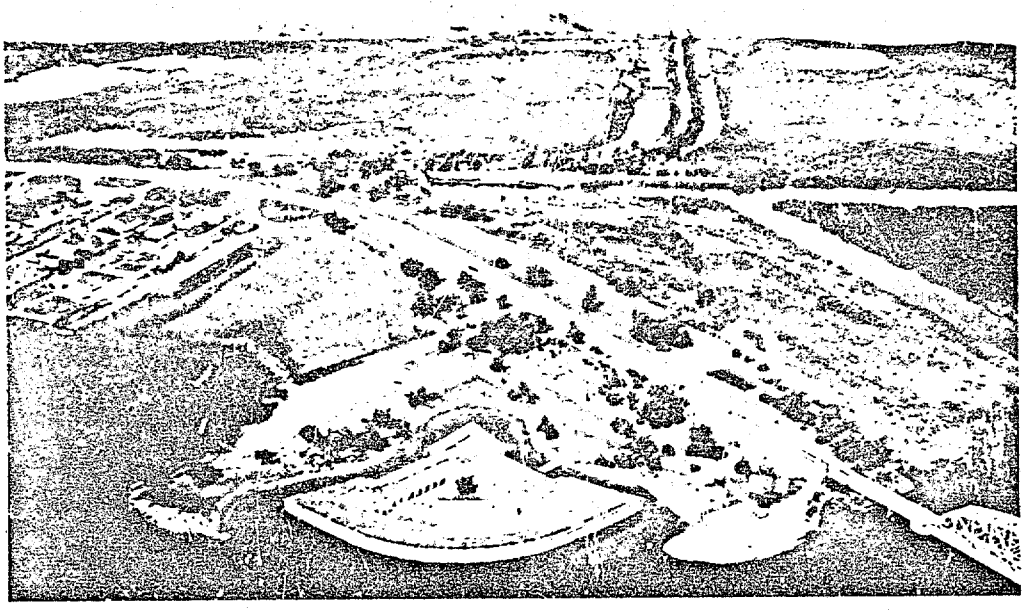
Fort Livingston, on the western end of Grand Terre Islands, and Fort Pike at The Rigolets, are being eroded by tidal currents. The most practicable method of preventing the erosion is by placement of a riprap blanket along the toe of the foundation of both of these forts.

ILLINOIS CENTRAL RAILROAD TRACKS

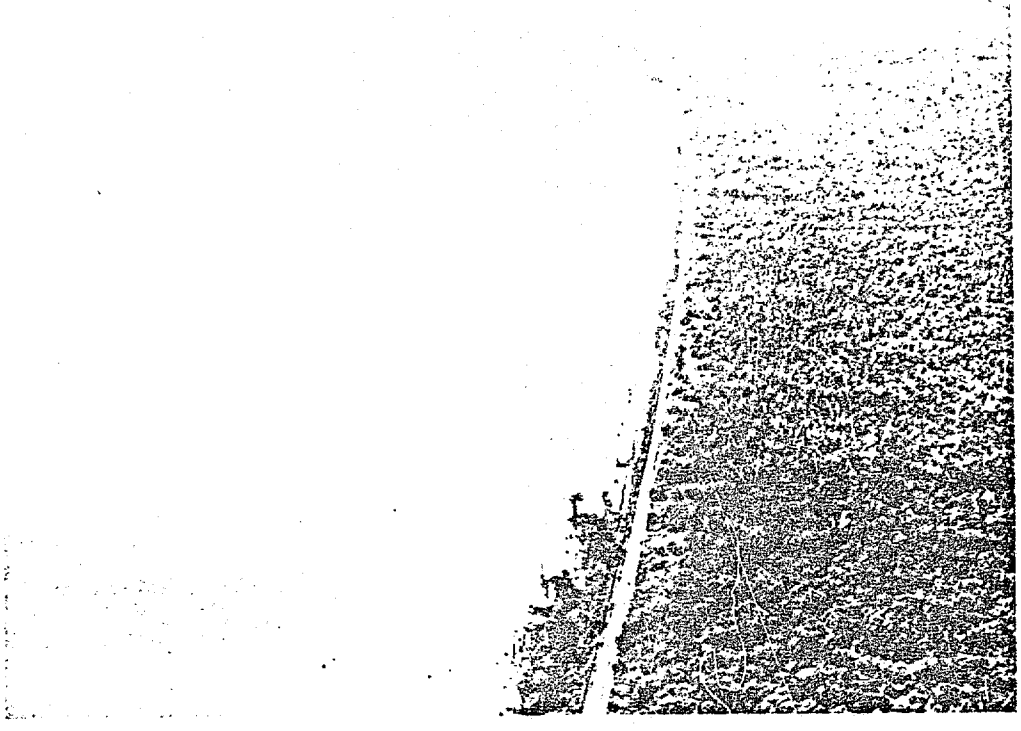
Riprap protection of the Illinois Central Railroad on the western side of Lake Pontchartrain will be required in the near future.

FONTAINEBLEAU STATE PARK

Restoration of the bathing beach at the Fontainebleau State Park will require direct placement of approximately 500,000 cubic yards of sand. This would provide a dry beach about 8,000 feet long and 300 feet wide. Annual maintenance would require an estimated 5,000 cubic yards a year.



Fort Pike State Park on the Rigolets, August 1970



Illinois Central Railroad Track on West Shore of Lake Pontchartrain, August 1970

Fontainebleau State Park on North Shore of Lake Pontchartrain, August 1970

SUMMARY

The estimated costs for the improvements outlined above are:

Zone	Area	Miles	First costs	Annual beach nourishrnent cost
IV	Grand Isle-beach	6.3	S1,800,000	S128,000
IV	Fort Livingston-riprap	0.1	40,000	--
VII	Fort Pike-riprap	0.1	30,000	--
VII	St. Charles Parish levee-riprap	5.7	500,000	--
VII	Illinois Central Railroad-riprap	2.1	190,000	--
VII	Mandeville seawall-riprap	1.5	360,000	--
VII	Fontainebleau State Park-beach	1.5	700,000	8,000
	Total	29.3	S4,700,000	S136,000

Section VIII

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Table 1

SHORE CLASSIFICATIONS

	Gulf Shoreline Exposure, miles							
	Zone I	Zone II	Zone III	Zone IV	Zone V	Zone VI	Zone VII	Total
A. PHYSICAL CHARACTERISTICS								
Shore with beach zone (sand)	96.0	16.0	21.0	100.0	29.0	94.0	9.0	365.0
Shore without beach zone (mud and/or silt)	18.0	5.0	0.0	0.0	186.0	220.0	16.0	445.0
B. HISTORICAL SHORE CHANGES								
Critical shore erosion	0.0	0.0	0.0	6.4	0.0	0.0	0.0	6.4
Non-critical shore erosion	59.1	21.0	21.0	92.6	36.0	314.0	25.0	568.7
Non-eroding shore (stable or accreting)	54.9	0.0	0.0	1.0	179.0	0.0	0.0	234.9
C. SHORE OWNERSHIP								
Public, Federal	0.0	0.0	0.0	0.0	101.6	58.5	0.0	160.1
Public, non-Federal	65.3	21.0	0.0	25.8	59.8	10.0	0.0	181.9
Private	48.7	0.0	21.0	74.2	53.6	245.5	25.0	468.0
D. SHORE USE (1970)								
Recreation, public	0.2	0.0	0.0	7.3	0.0	0.0	0.0	7.5
Recreation, private	2.1	0.0	0.0	0.0	0.0	0.0	0.0	2.1
Non-recreatioanal development	5.9	0.0	0.0	1.3	0.0	0.0	0.0	7.2
Undeveloped	105.8	21.0	21.0	91.4	215.0	314.0	25.0	793.2
TOTAL	114.0	21.0	21.0	100.0	215.0	314.0	25.0	810.0

(Continued)

Table 1 (Concluded)

Bay, Lake, and Estuary Shorelines, miles

	Zone I		Zone II			Zone III	Zone IV			Zone V	Zone VI	Zone VII			
	Sabine Lake	Calcasieu Lake	Vermilion Bay	E&W Cote Blanche Bays	Atchafalaya Bay		Terrebonne and Timbalier Bays	Caminada and Barataria Bays	Bastion Bay	Miss. River Passes		Lake Borgne	Lake Pontchartrain	Rigolets and Chef Menteur Passes and Lake St. Catharine	Total
A. PHYSICAL CHARACTERISTICS															
Shore with beach zone (sand)	15.0	56.0	36.0	34.0	34.0	0.0	111.0	40.0	23.0	0.0	0.0	37.0	84.0	0.0	470.0
Shore without beach zone (mud and/or silt)	15.0	10.0	44.0	43.0	59.0	0.0	102.0	134.0	6.0	106.0	0.0	51.0	35.0	58.0	663.0
B. HISTORICAL SHORE CHANGES															
Critical shore erosion	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.8	0.1	22.9
Non critical shore erosion	30.0	66.0	80.0	77.0	93.0	0.0	213.0	174.0	29.0	0.0		88.0	77.2	57.9	385.1
Non eroding shore (stable or accreting)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	106.0	0.0	0.0	19.0	0.0	125.0
C. SHORE OWNERSHIP															
Public, Federal	9.9	17.3	0.0	0.0	0.0	0.0	0.0	0.2	0.0	55.7	0.0	0.0	2.3	0.0	85.4
Public, non Federal	0.6	8.8	32.1	31.5	0.0	0.0	18.5	17.2	4.8	5.1	0.0	0.0	31.3	0.1	150.0
Private	19.5	39.9	47.9	45.5	93.0	0.0	194.5	156.6	24.2	45.2	0.0	88.0	85.4	57.9	897.6
D. SHORE USE (1970)															
Recreation, public	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.0	9.3	0.1	10.3
Recreation, private	0.0	2.7	1.2	0.0	0.0	0.0	0.0	7.4	0.0	0.0	0.0	0.0	9.5	5.3	26.1
Non recreation development	0.2	4.2	0.0	0.0	0.0	0.0	0.0	4.3	0.0	1.5	0.0	0.0	28.4	0.5	39.1
Undeveloped	29.8	59.1	78.2	77.0	93.0	0.0	213.0	162.2	29.0	104.3	0.0	88.0	71.8	52.1	1 0574.5
TOTAL	30.0	66.0	80.0	77.0	93.0	0.0	213.0	174.0	29.0	106.0	0.0	88.0	119.0	58.0	* 1,133.0

Table 2

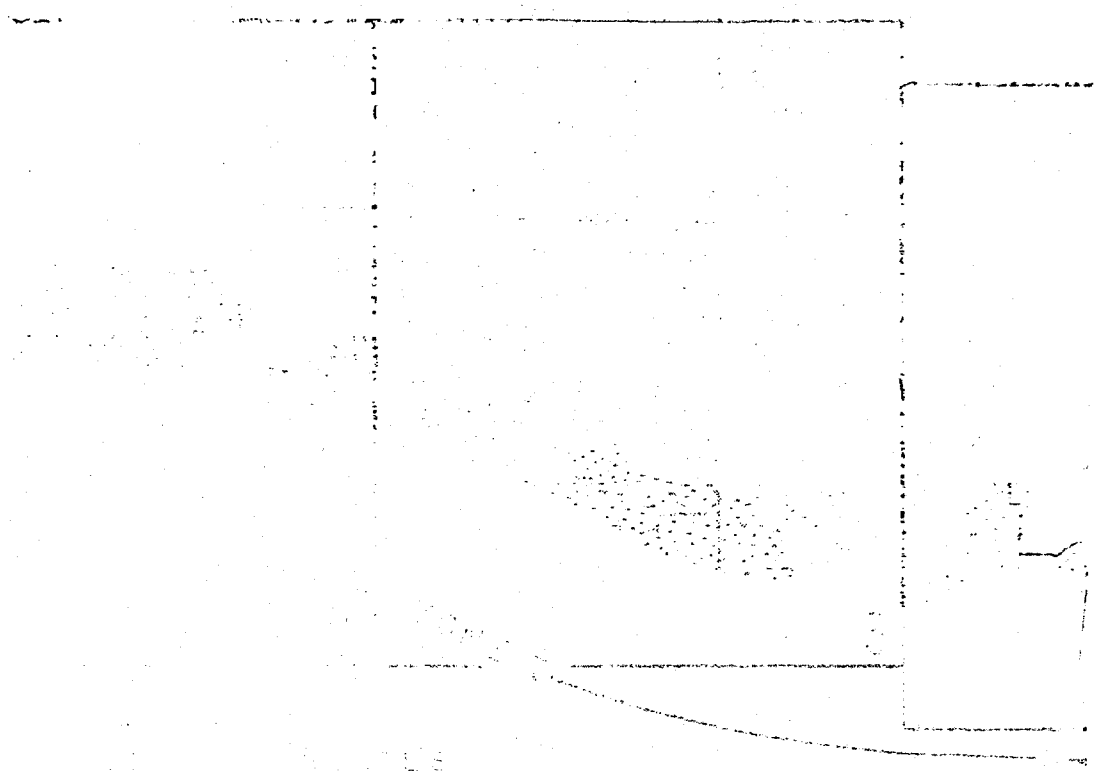
BARGE NAVIGATION PROJECTS IN THE LOUISIANA COASTAL AREA

Name of project	Size	Status
Johnson Bayou	6 ft. deep	complete
Calcasieu River	12 x 200 ft.	complete
Mermentau River	3,000 sq. ft.	complete
Freshwater Bayou	12 x 125 ft.	complete
Bayou Teche and Vermilion River		
Vermilion Bay - GIWW	8 x 80 ft.	complete
GIWW - Lafayette	9 x 100 ft.	complete
Petit Anse, Tigre, and Carlin Bayous		
Avery Canal	7 x 60 ft.	complete
Bayou Petit Anse	9 x 80 ft.	complete
Bayou Carlin	9 x 80 ft.	complete
Atchafalaya River, Morgan City to the Gulf of Mexico		
Gulf - Atchafalaya	20 x 200 ft.	complete
Gulf to Bayous Black and Boeuf	20 x 400 ft.	not started
Houma Navigation Canal	15 x 150 ft.	complete
Little Caillou Bayou	5 x 40 ft.	complete
Bayou Terrebonne	6 ft. deep	complete
Bayou Lafourche		
Gulf to Leeville	12 x 125 ft.	complete
Leeville - Golden Meadow	9 x 100 ft.	complete
Golden Meadow - GIWW	6 x 60 ft.	complete
Auxiliary By-Pass Channel, Leeville to GIWW	12 x 125 ft.	not started
Lafourche - Jump W/W, Leeville to Grand Isle	12 x 125 ft.	not started
Barataria Bay Waterway		
Gulf - GIWW	12 x 125 ft.	complete
Bayou Rigaud	12 x 125 ft.	complete

(Continued)

Table 2 (Concluded)

Name of project	Size	Status
Waterway from Empire, La., to the Gulf of Mexico	9 x 80 ft.	complete
Mississippi River Outlets in Vicinity of Venice		
Grand and Tiger Passes	14 x 150 ft.	not started
Baptiste Collette Bayou	14 x 150 ft.	not started
Bayous La Loutre, St. Malo and Yscioskey		
Bayou La Loutre	6 x 40 ft. and 5 x 30 ft.	complete
Bayou St. Malo	6 x 40 ft.	complete
Bayou Yscloskey (bar channel)	5 x 40 ft.	complete
Gulf Intracoastal Waterway		
Mississippi River - Mobile	12 x 150 ft.	complete
Mississippi River - Morgan City	16 x 150 ft.	12 x 125 ft. complete
Morgan City - Texas Boundary	16 x 200 ft.	12 x 125 ft. complete
Pass Manchac	Removal of snags, etc.	complete
Tangipahoa River		
Bar channel	8 x 100 ft.	not started
Mile 0 - 53	Removal of snags, etc.	complete
Tchefuncta River and Bogue Falia		
Lake - Mile 3.5	10 x 125 ft.	complete
Mile 3.5 - Covington	8 ft. depth	complete
Bayou Lacombe		
Bar	8 x 60 ft.	complete
Bar to Mile 8.2	Removal of snags, etc.	complete
Bayou Bonfouca	10 x 60 ft.	complete
Pearl River		
Mile 0 - 28.5	7 x 100 ft.	complete
28.5 - 48.7	7 x 80 ft.	complete
48.7 - 58	7 x 100 ft.	complete



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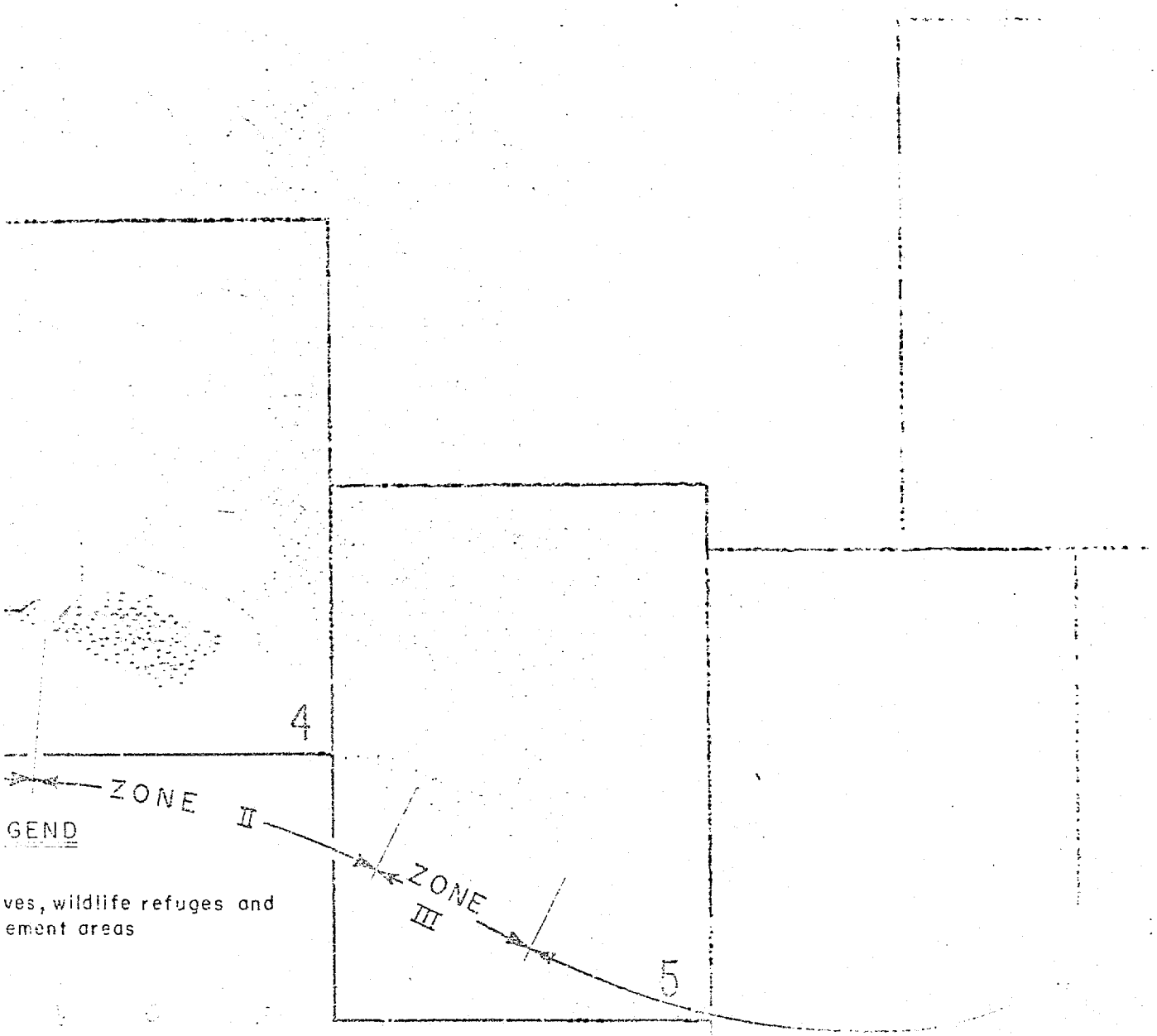

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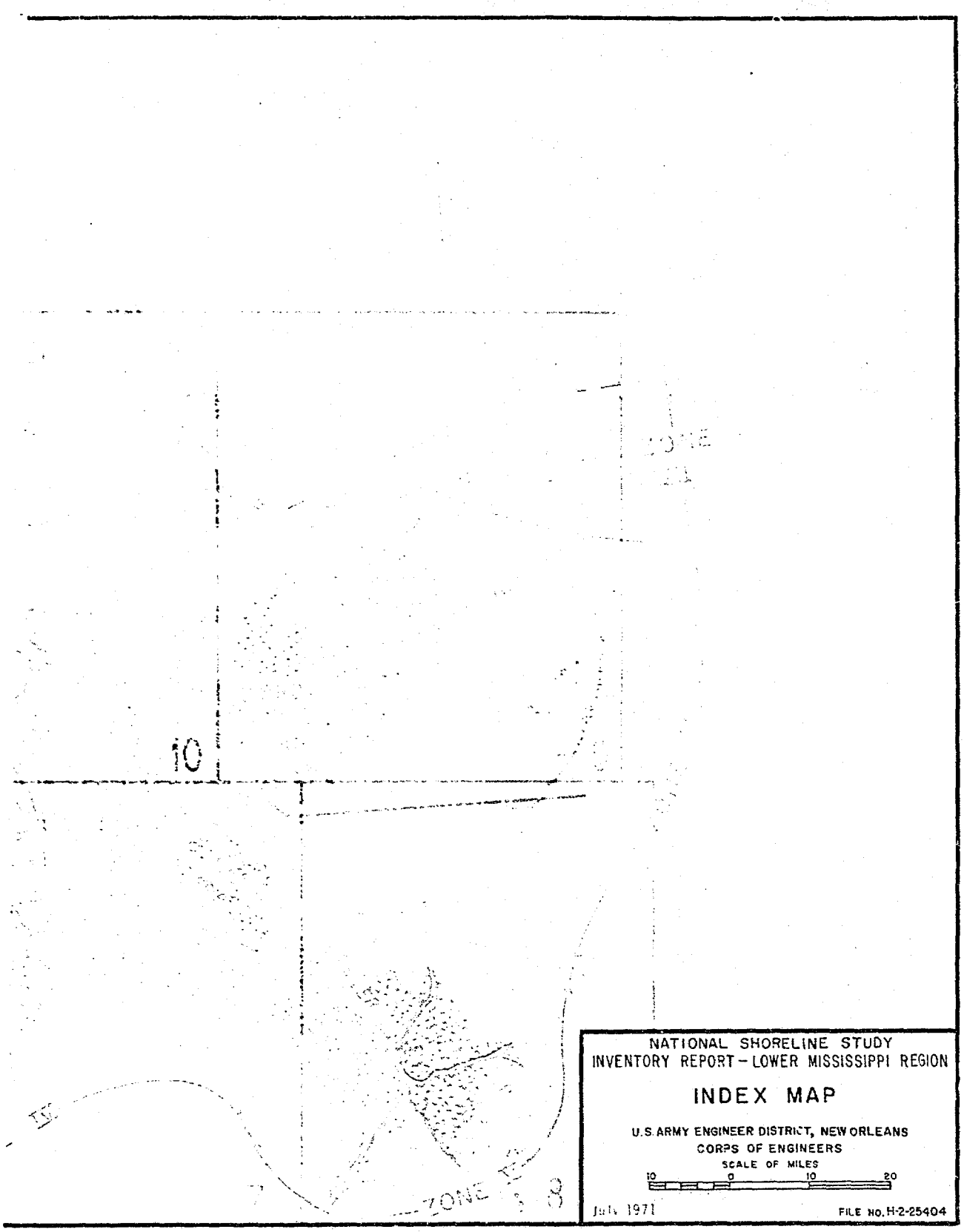

NATIONAL SHORELINE STUDY
INVENTORY REPORT – LOWER MISSISSIPPI REGION

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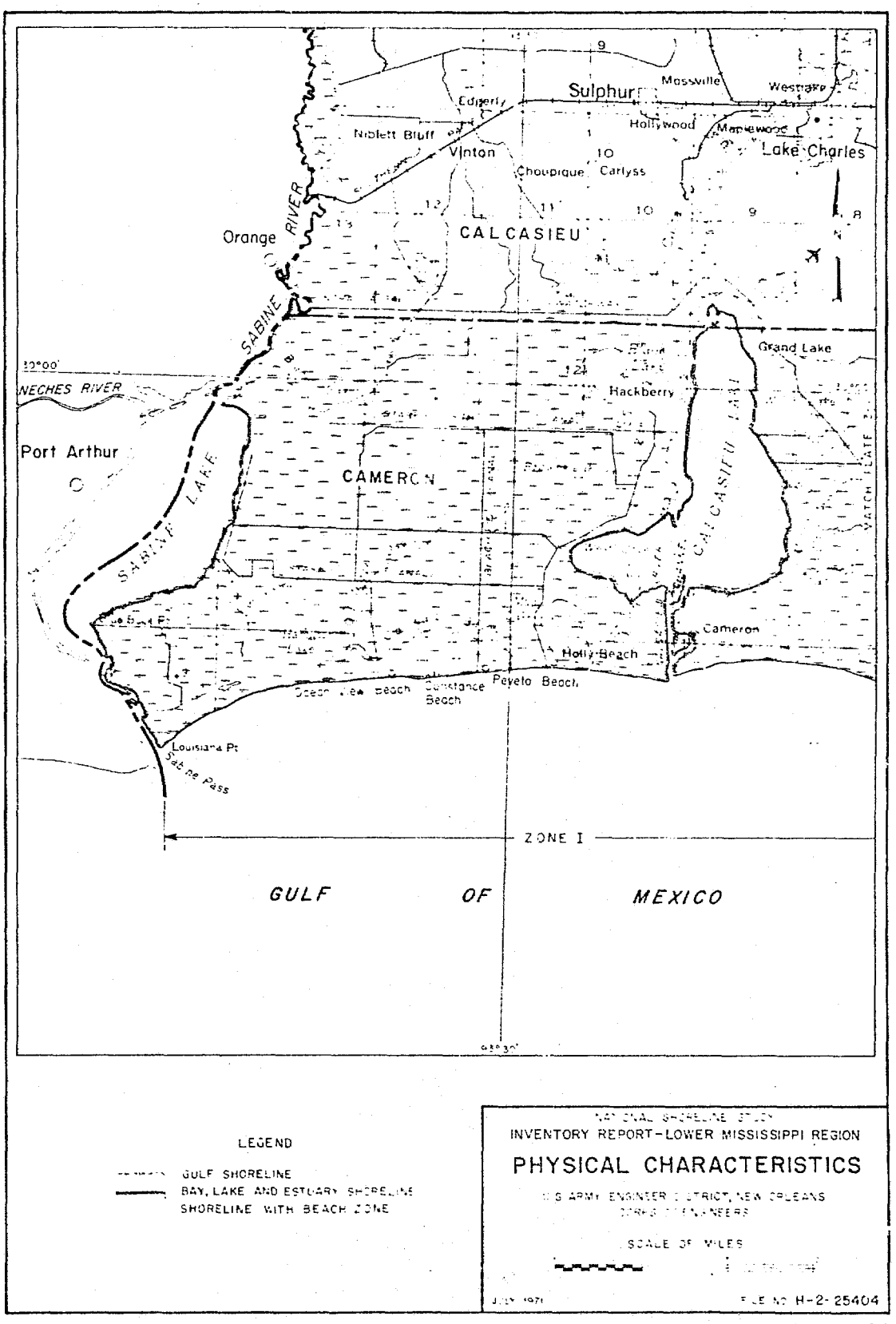
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SCALE OF MILES
10 0 10 20

July 1971

FILE NO. H-2-25404

PLATE 1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Vinton
Choupique
Carlyss
Orange
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CALCASIEU
Grand Lake
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NECHES RIVER
Hackberry
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SABINE LAKE
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SHORELINE WITH BEACH ZONE
INVENTORY REPORT-LOWER MISSISSIPPI REGION
PHYSICAL CHARACTERISTICS
SCALE OF MILES
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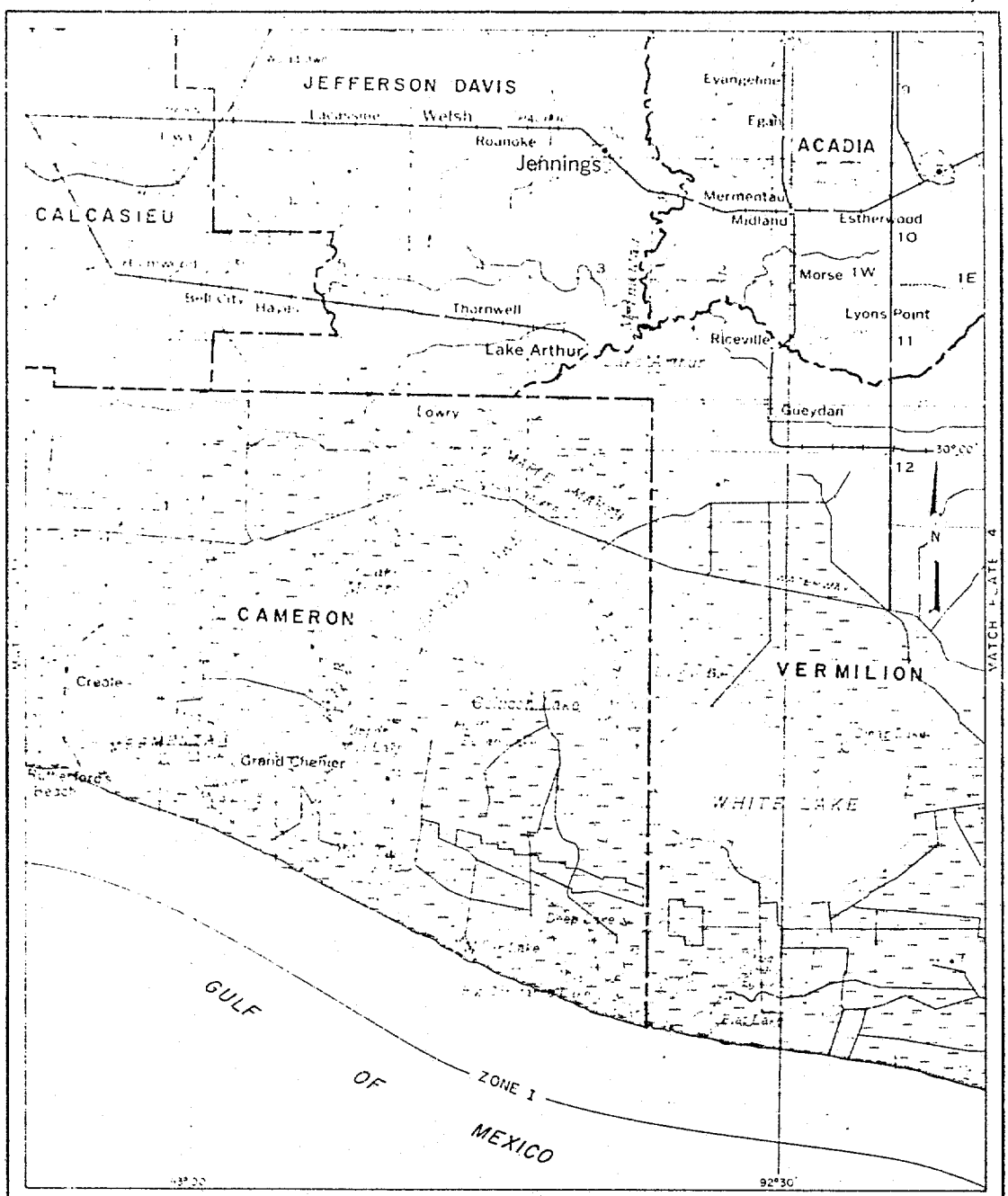
PLATE 2A



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GULF SHORELINE

BAY, LAKE AND ESTUARY SHORELINE

SHORELINE WITH BEACH ZONE

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PLATE 3A

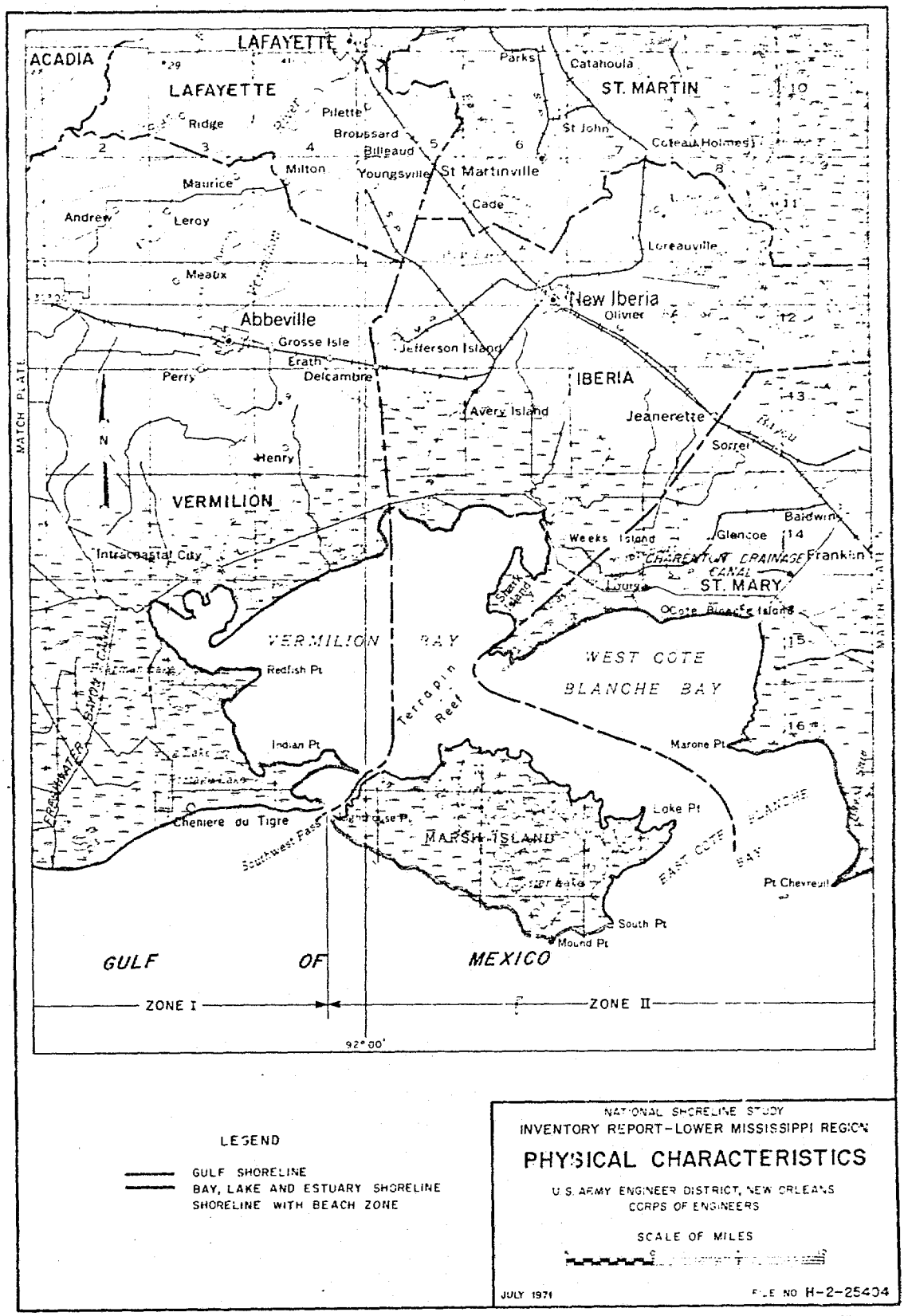

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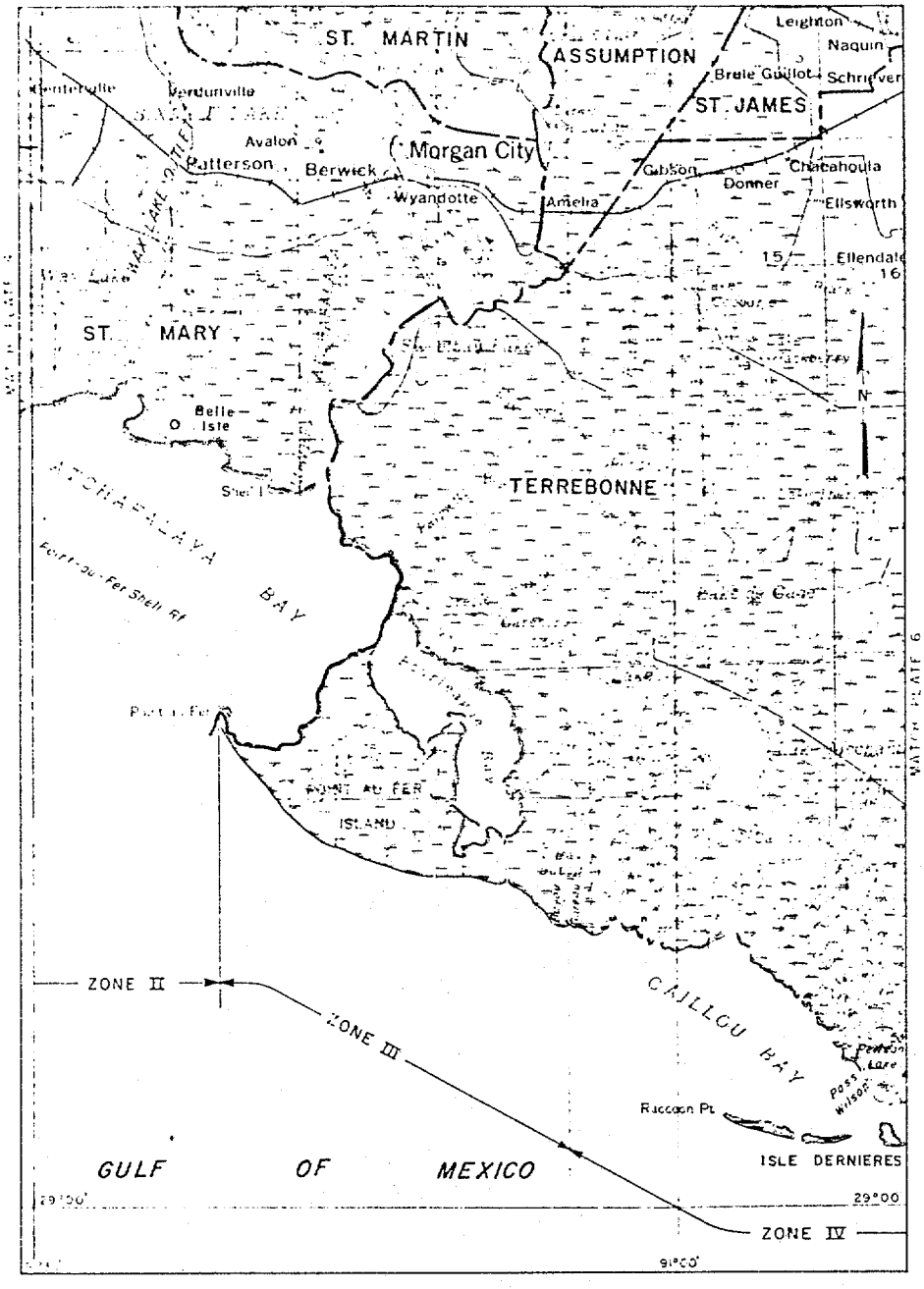
PLATE 4A



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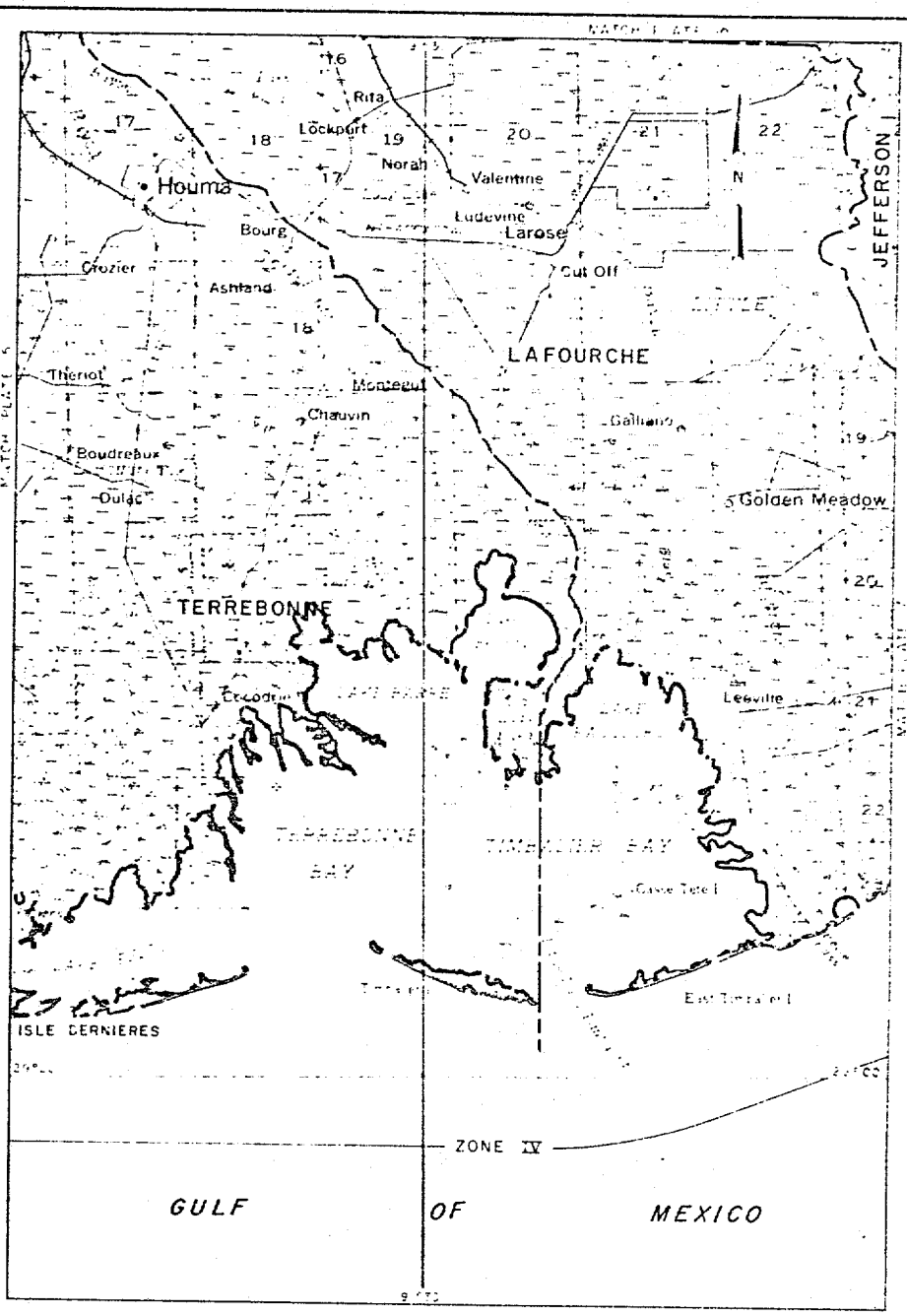

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PHYSICAL CHARACTERISTICS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS

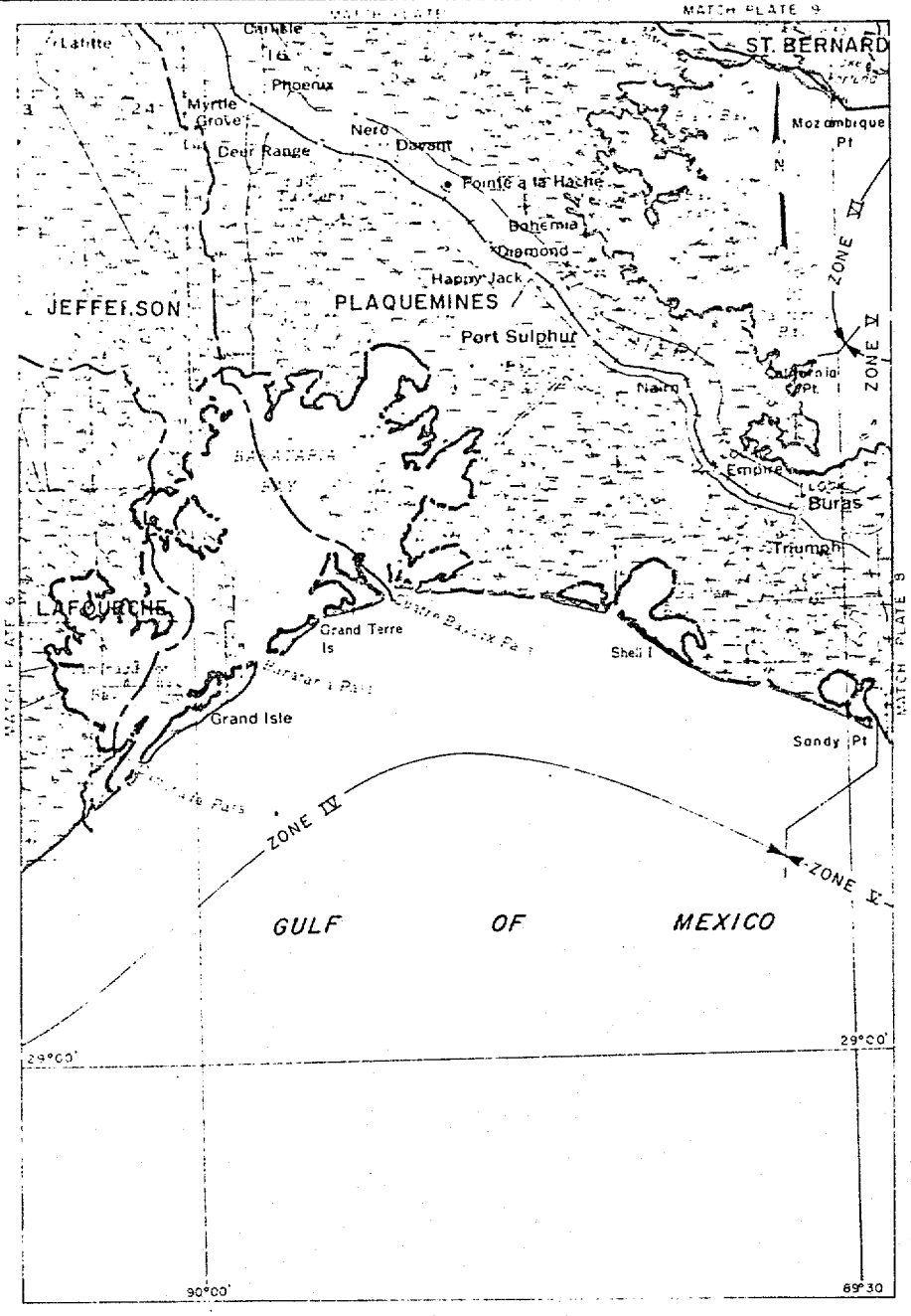
CORPS OF ENGINEERS

SCALE OF MILES

JULY 1971

FILE NO. H-2-25404

PLATE 6A



LEGEND

GULF SHORELINE

BAY, LAKE AND ESTUARY SHORELINE

SHORELINE WITH BEACH ZONE

NATIONAL SHORELINE STUDY

INVENTORY REPORT–LOWER MISSISSIPPI REGION

PHYSICAL CHARACTERISTICS

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

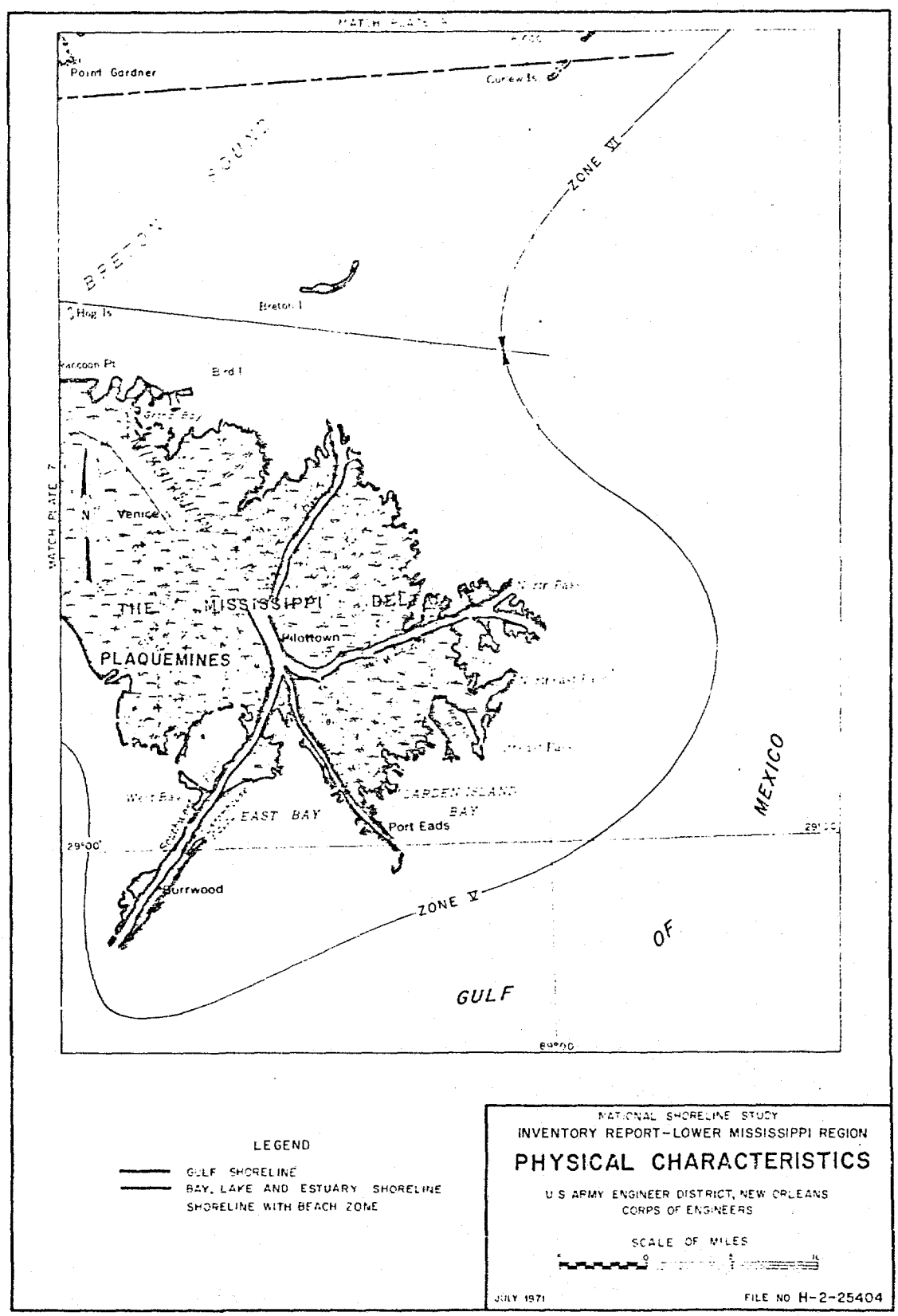
SCALE OF MILES

0 5 10

JULY 1971

FILE NO H-2-25404

PLATE 7A



LEGEND

GULF SHORELINE

BAY, LAKE AND ESTUARY SHORELINE

SHORELINE WITH BEACH ZONE

NATIONAL SHORELINE STUDY

INVENTORY REPORT–LOWER MISSISSIPPI REGION

PHYSICAL CHARACTERISTICS

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

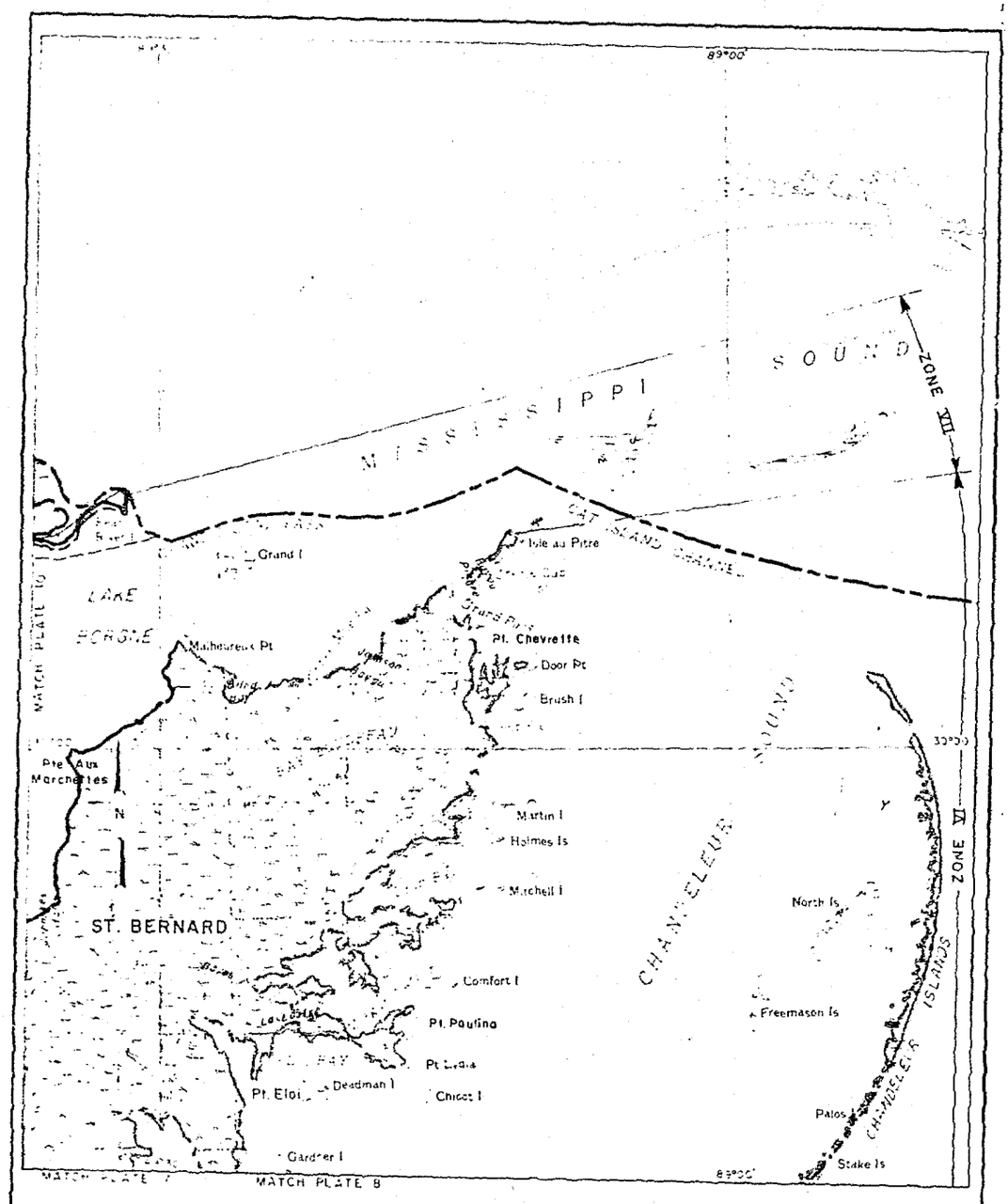
SCALE OF MILES

0 5 10

JULY 1971

FILE NO H-2-25404

PLATE 8A



LEGEND

GULF SHORELINE

BAY, LAKE AND ESTUARY SHORELINE

SHORELINE WITH BEACH ZONE

NATIONAL SHORELINE STUDY

INVENTORY REPORT–LOWER MISSISSIPPI REGION

PHYSICAL CHARACTERISTICS

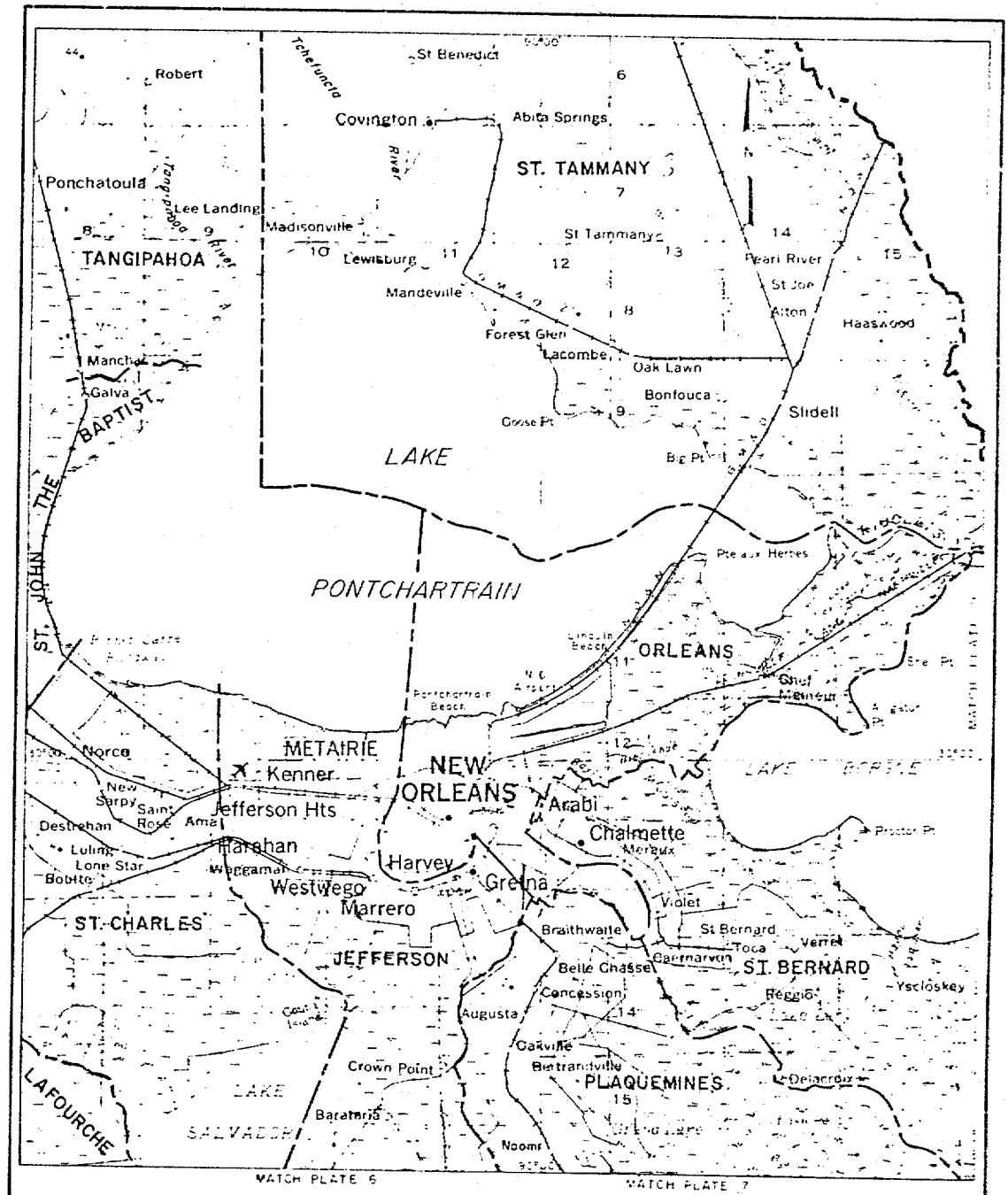
U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SCALE OF MILES

JULY 1971

FILE NO H-2-25404

PLATE 9A



LEGEND

GULF SHORELINE
BAY, LAKE AND ESTUARY SHORELINE
SHORELINE WITH BEACH ZONE

NATIONAL SHORELINE STUDY
INVENTORY REPORT—LOWER MISSISSIPPI REGION

PHYSICAL CHARACTERISTICS

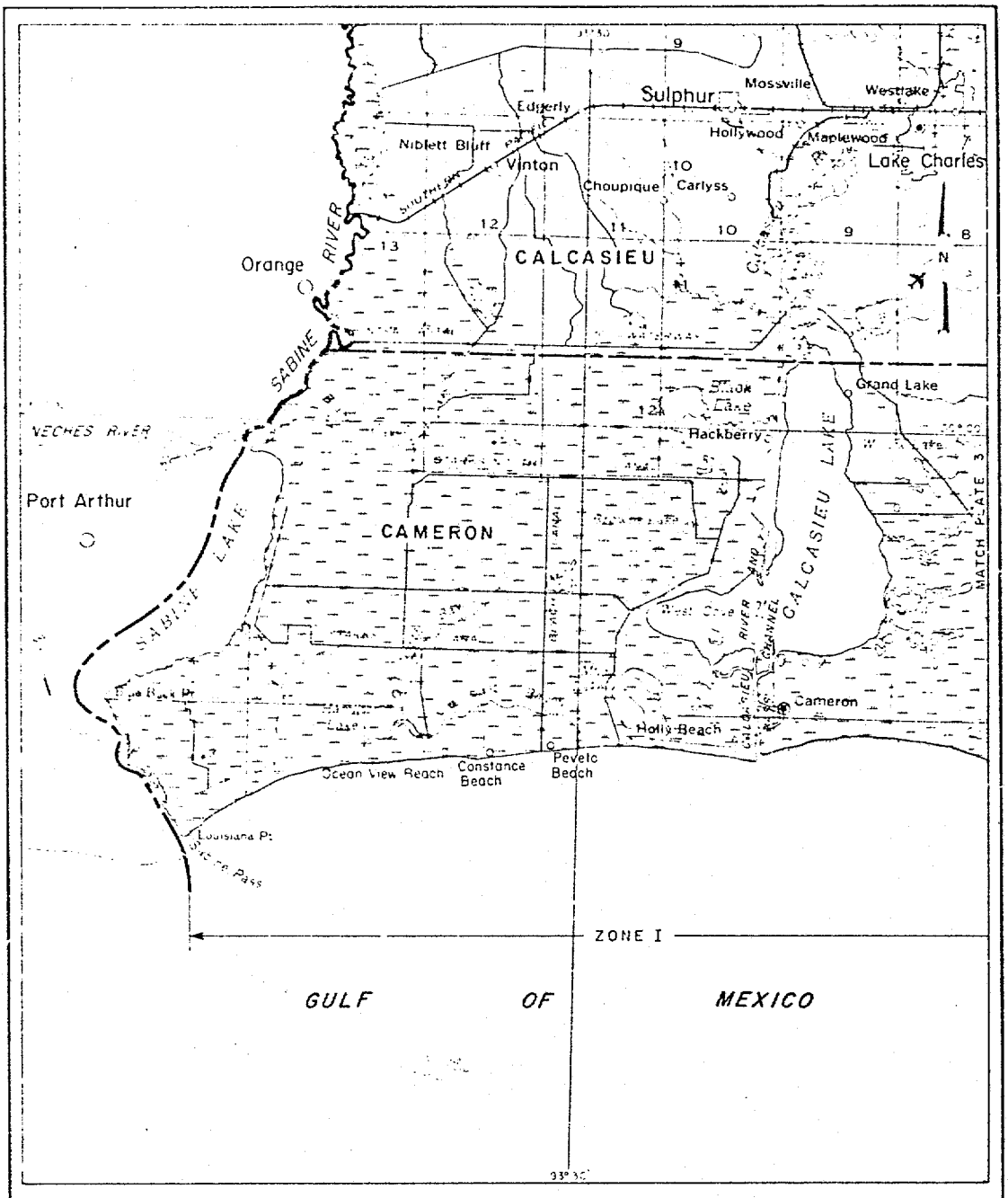
U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SCALE OF MILES

JULY 1971

FILE NO H-2-25404

PLATE IC-A



LEGEND

CRITICAL SHORE EROSION

NON-CRITICAL SHORE EROSION

NON-ERODING SHORE (STABLE OR ACCRETING)

NATIONAL SHORELINE STUDY

INVENTORY REPORT-LOWER MISSISSIPPI REGION

HISTORICAL SHORE CHANGES

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SCALE OF MILES

JULY 197

FILE NO. H-2-25404

PLATE 2B

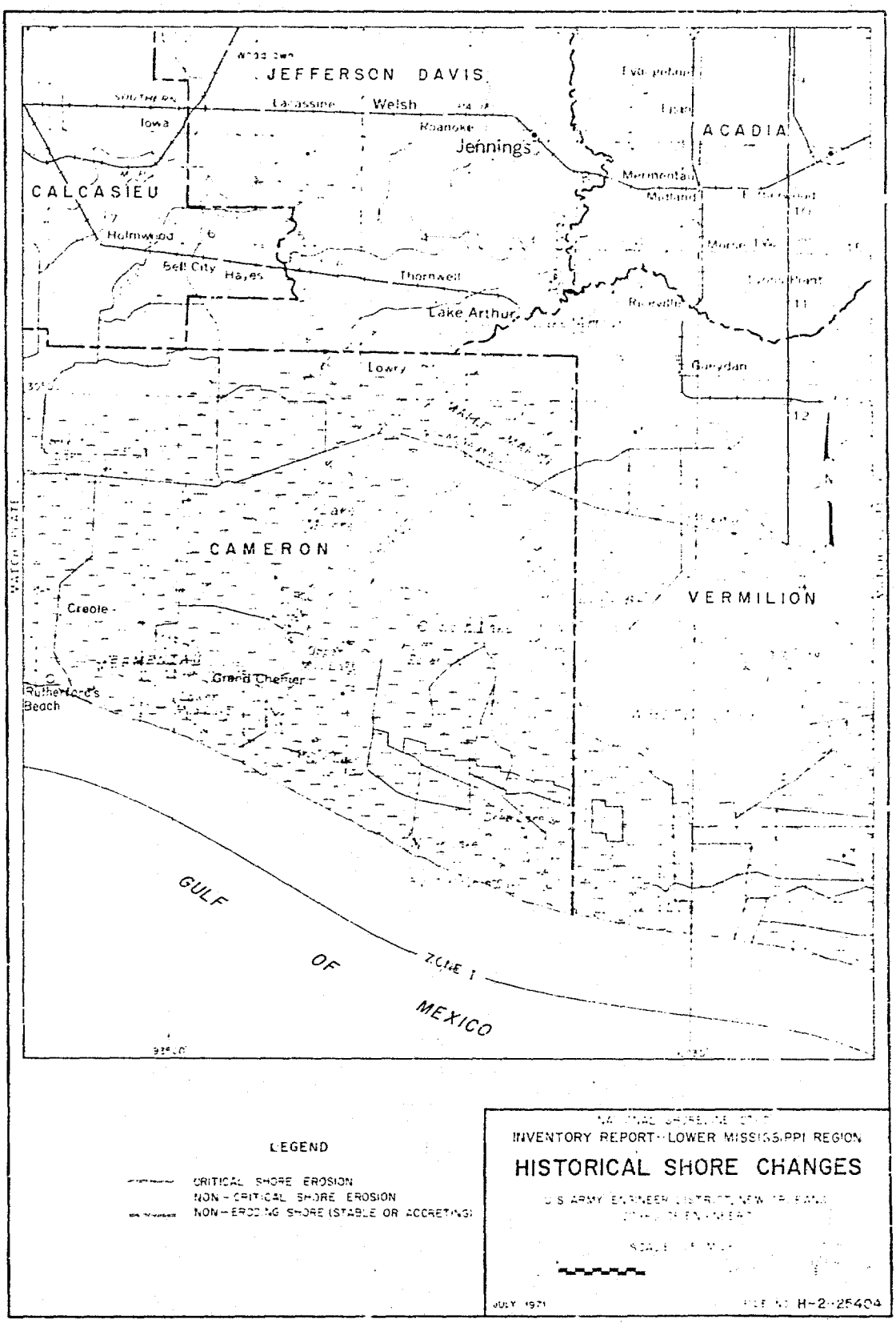
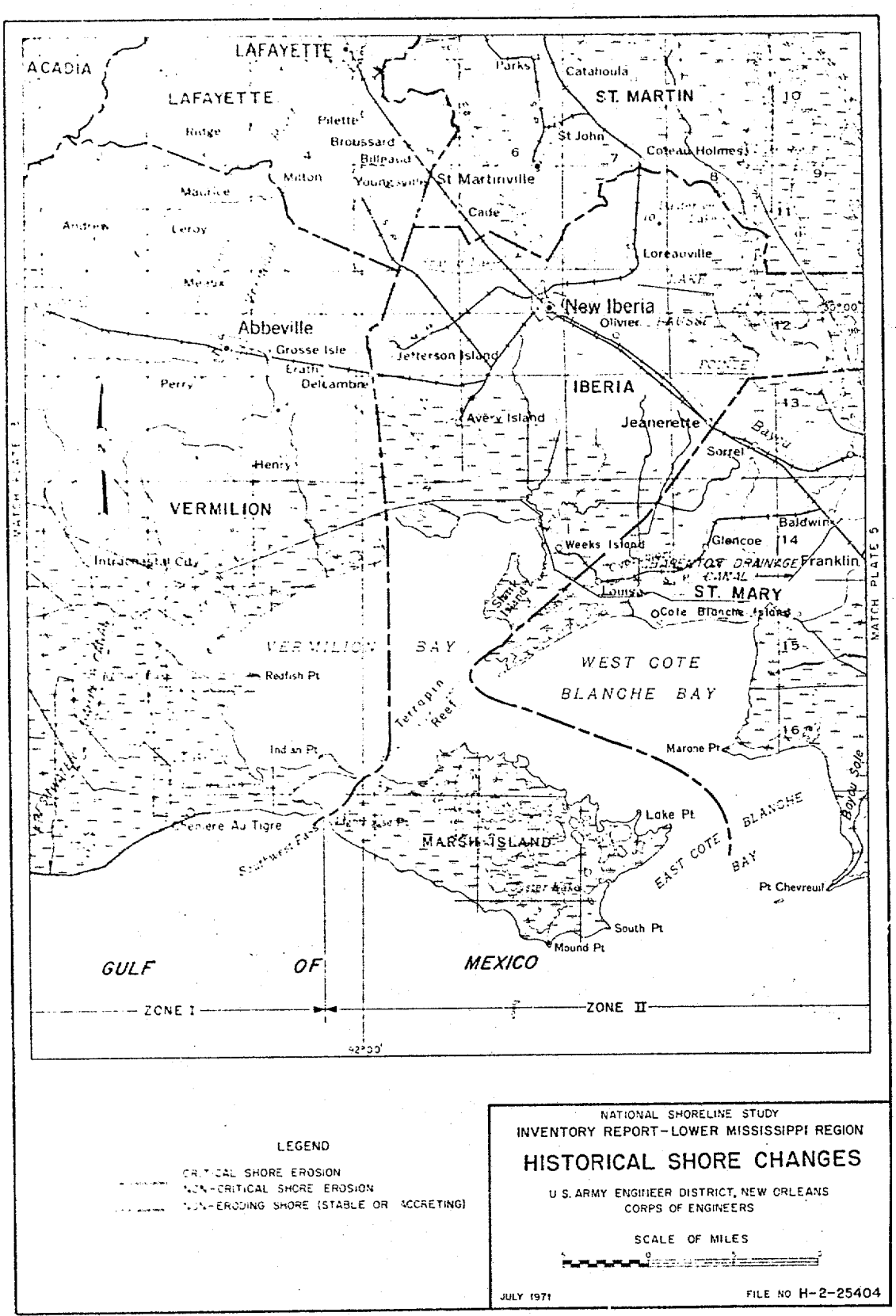

JEFFERSON DAVIS
Lacassine
Welsh
Iowa
Roanoke
Jennings
ACADIA
CALCASIEU
Holmwood
Bell City
Hayes
Thornwell
Lake Arthur
Gueydan
CAMEREON
VERMILION
Creole
Grand Chenier
Rutherford's Beach
GULF OF MEXICO
ZONE 1
LEGEND
CRITICAL SHORE EROSION
NON-CRITICAL SHORE EROSION
NON-ERODING SHORE (STABLE OR ACCRETING)
INVENTORY REPORT--LOWER MISSISSIPPI REGION
HISTORICAL SHORE CHANGES
JULY 1971
H-2-25404

PLATE 3B



LEGEND

CRITICAL SHORE EROSION

NON-CRITICAL SHORE EROSION

NON-ERODING SHORE (STABLE OR ACCRETING)

NATIONAL SHORELINE STUDY

INVENTORY REPORT - LOWER MISSISSIPPI REGION

HISTORICAL SHORE CHANGES

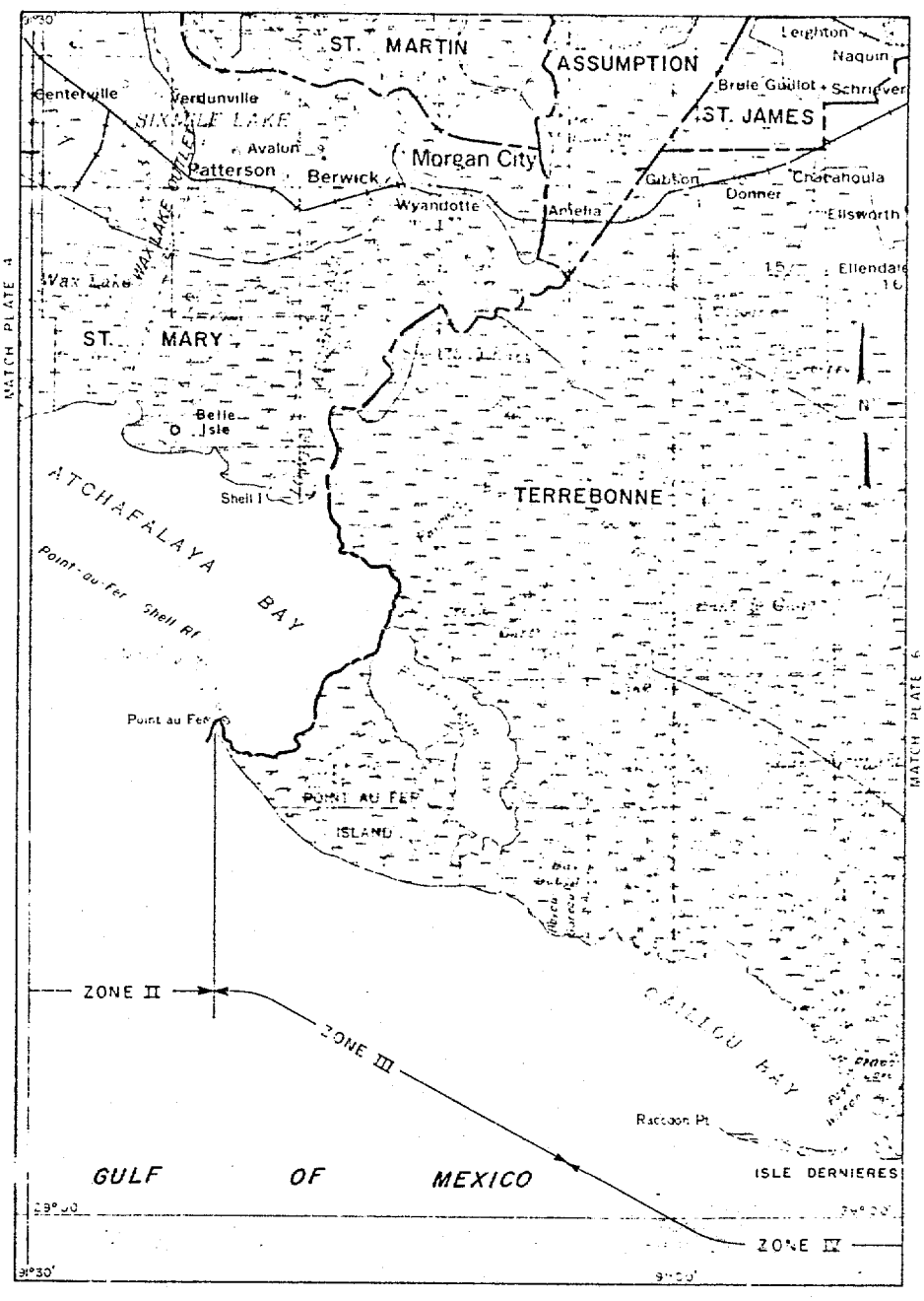
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SCALE OF MILES

JULY 1971

FILE NO H-2-25404

PLATE 4B



LEGEND

CRITICAL SHORE EROSION
NON-CRITICAL SHORE EROSION
NON-ERODING SHORE (STABLE OR ACCRETING)

NATIONAL SHORELINE STUDY
INVENTORY REPORT-LOWER MISSISSIPPI REGION

HISTORICAL SHORE CHANGES

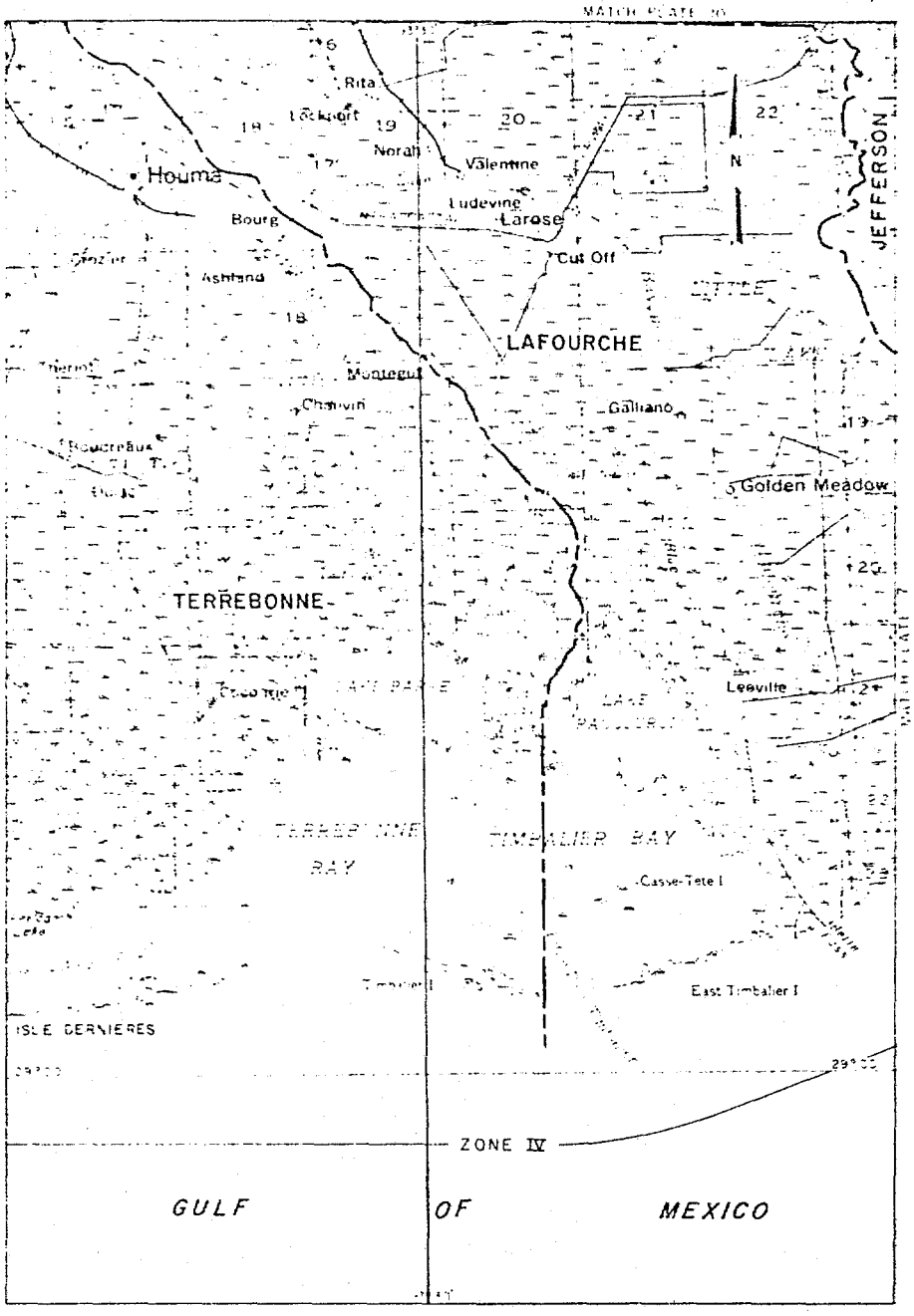
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SCALE OF MILES

JULY 1971

FILE NO. H-2-25404

PLATE 5B



LEGEND

CRITICAL SHORE EROSION
NON-CRITICAL SHORE EROSION
NON-ERODING SHORE (STABLE OR ACCRETING)

NATIONAL SHORELINE STUDY
INVENTORY REPORT - LOWER MISSISSIPPI REGION

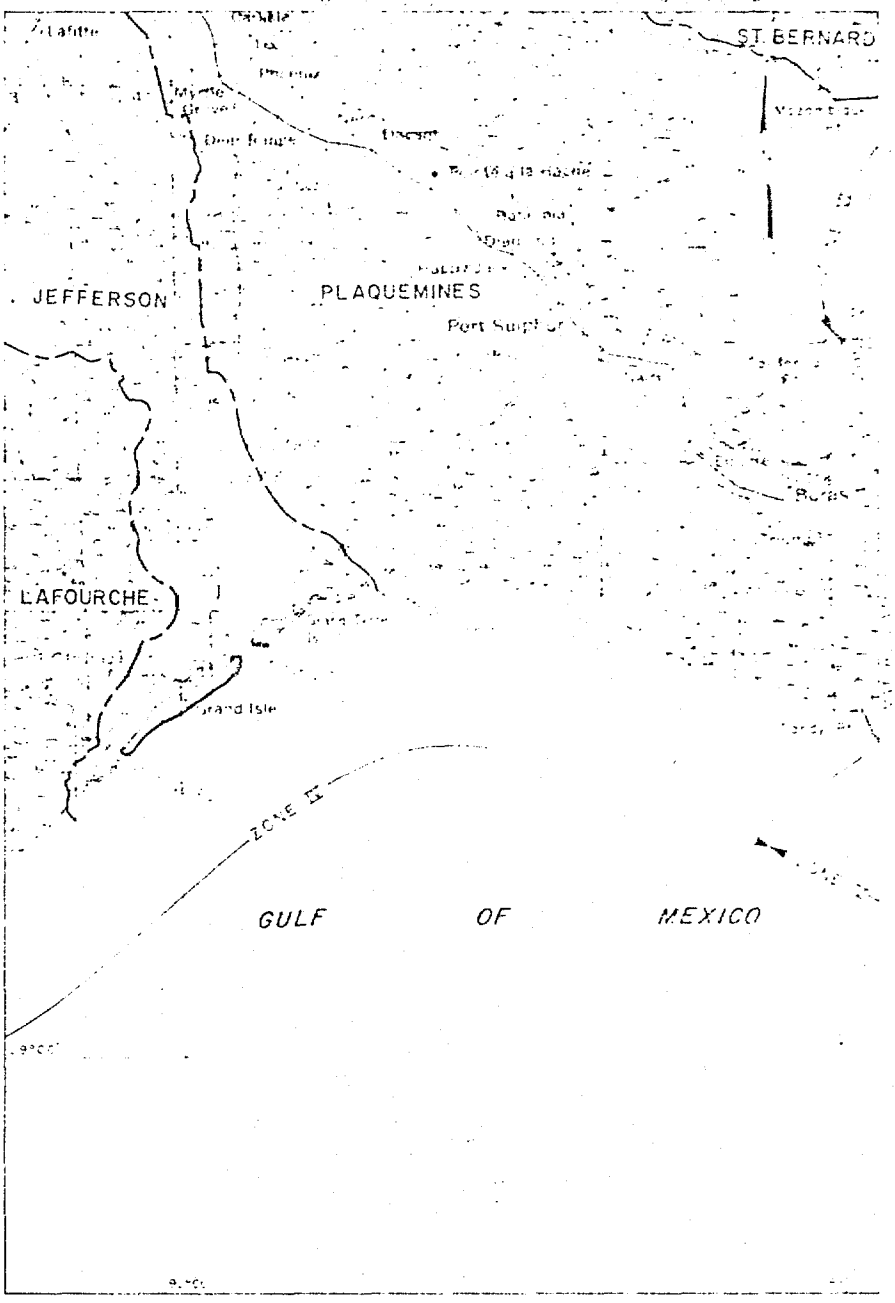
HISTORICAL SHORE CHANGES

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SCALE OF MILES

JULY 1971 FILE NO. H-2-25404

PLATE 6B



LEGEND

CRITICAL SHORE EROSION

NON-CRITICAL SHORE EROSION

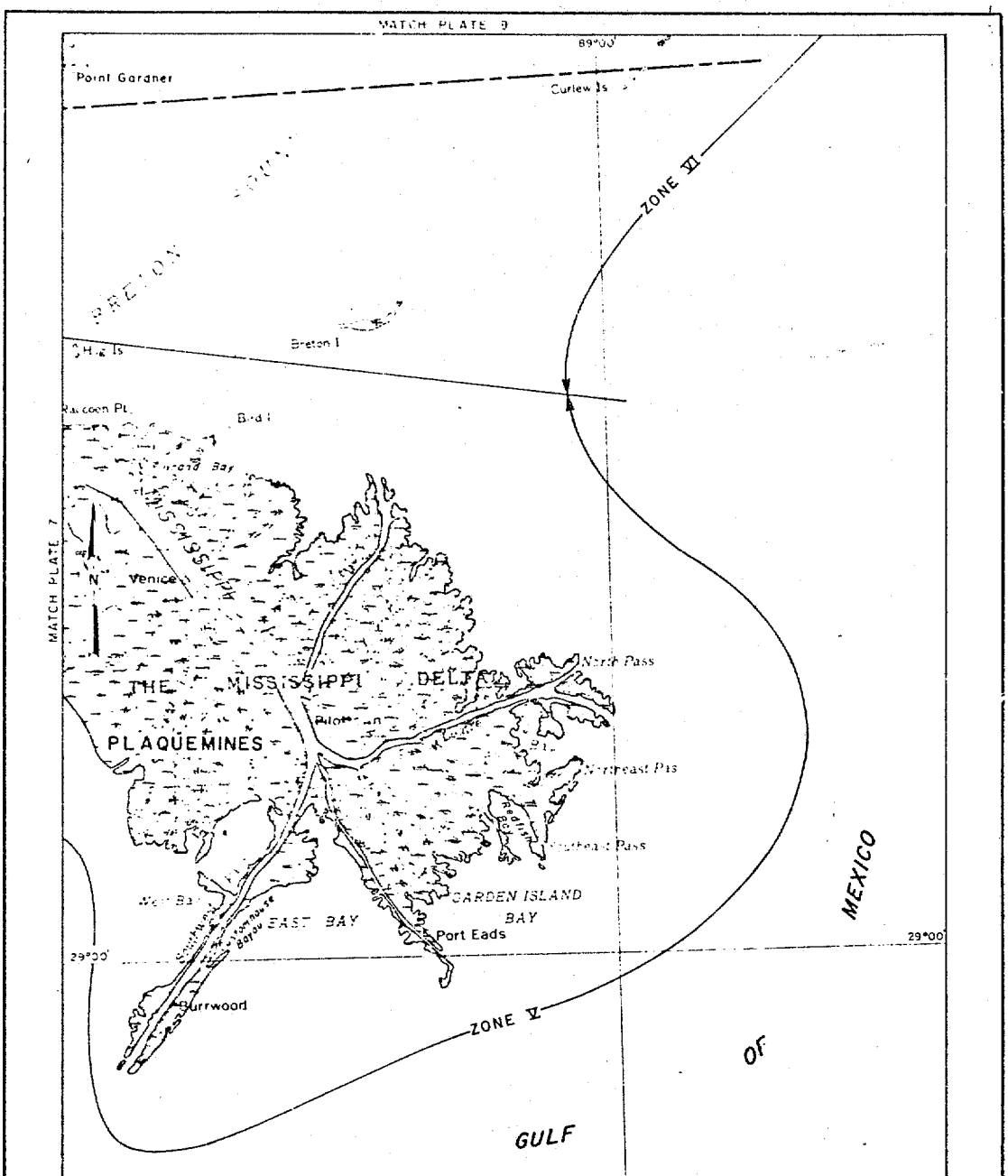
NON-ERODING SHORE (STABLE OR ACCRETING)

INVENTORY REPORT—LOWER MISSISSIPPI REGION

HISTORICAL SHORE CHANGES

H-2-25404

PLATE 7B



LEGEND

CRITICAL SHORE EROSION

NON-CRITICAL SHORE EROSION

NON-ERODING SHORE (STABLE OR ACCRETING)

NATIONAL SHORELINE STUDY

INVENTORY REPORT-LOWER MISSISSIPPI REGION

HISTORICAL SHORE CHANGES

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SCALE OF MILES

5 0 5 10

JULY 1971

FILE NO H-2-25404

PLATE 8B

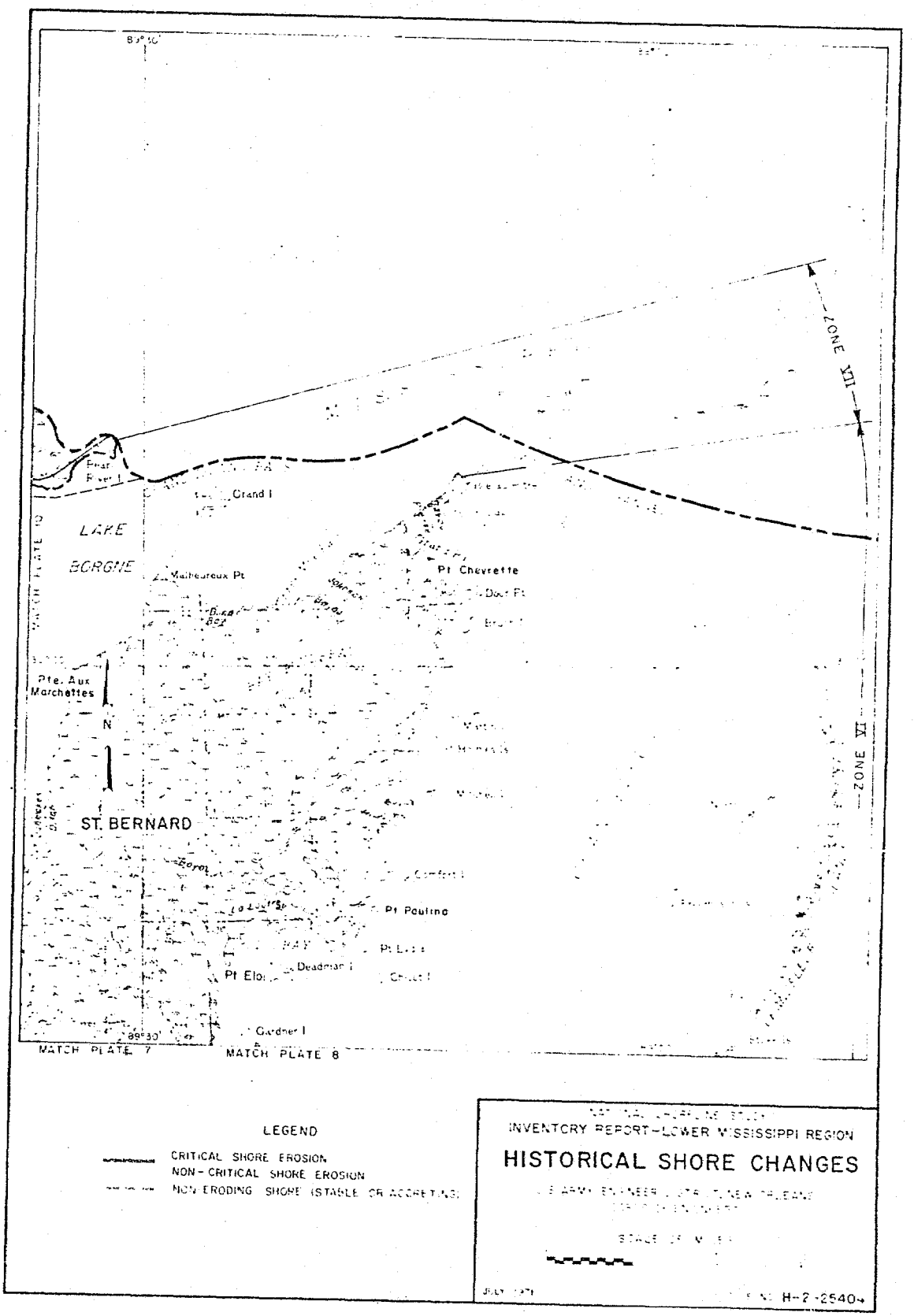
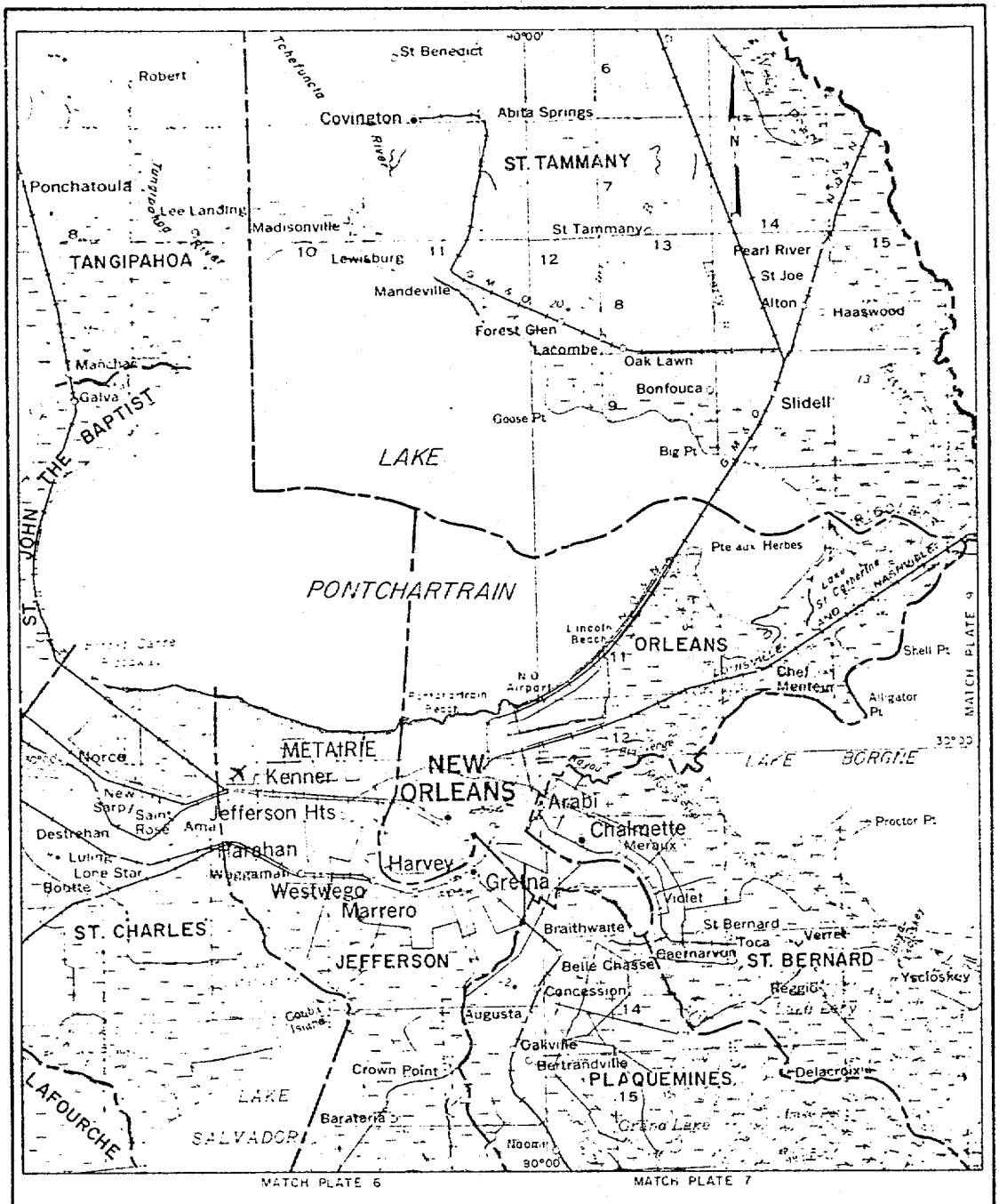

LAKE
BORGNE
Malheureux Pt
Pt Chevrette
Pte. Aux
Marchettes
N
ST. BERNARD
Grand I
Pt Paulina
Deadman I
Gardner I
ZONE XII
ZONE XI
MATCH PLATE 7
MATCH PLATE 8
LEGEND
CRITICAL SHORE EROSION
NON-CRITICAL SHORE EROSION
NON ERODING SHORE (STABLE OR ACCRETING)
INVENTORY REPORT-LOWER MISSISSIPPI REGION
HISTORICAL SHORE CHANGES

PLATE 9B



LEGEND

CRITICAL SHORE EROSION

NON-CRITICAL SHORE EROSION

NON-ERODING SHORE (STABLE OR ACCRETING)

NATIONAL SHORELINE STUDY

INVENTORY REPORT-LOWER MISSISSIPPI REGION

HISTORICAL SHORE CHANGES

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

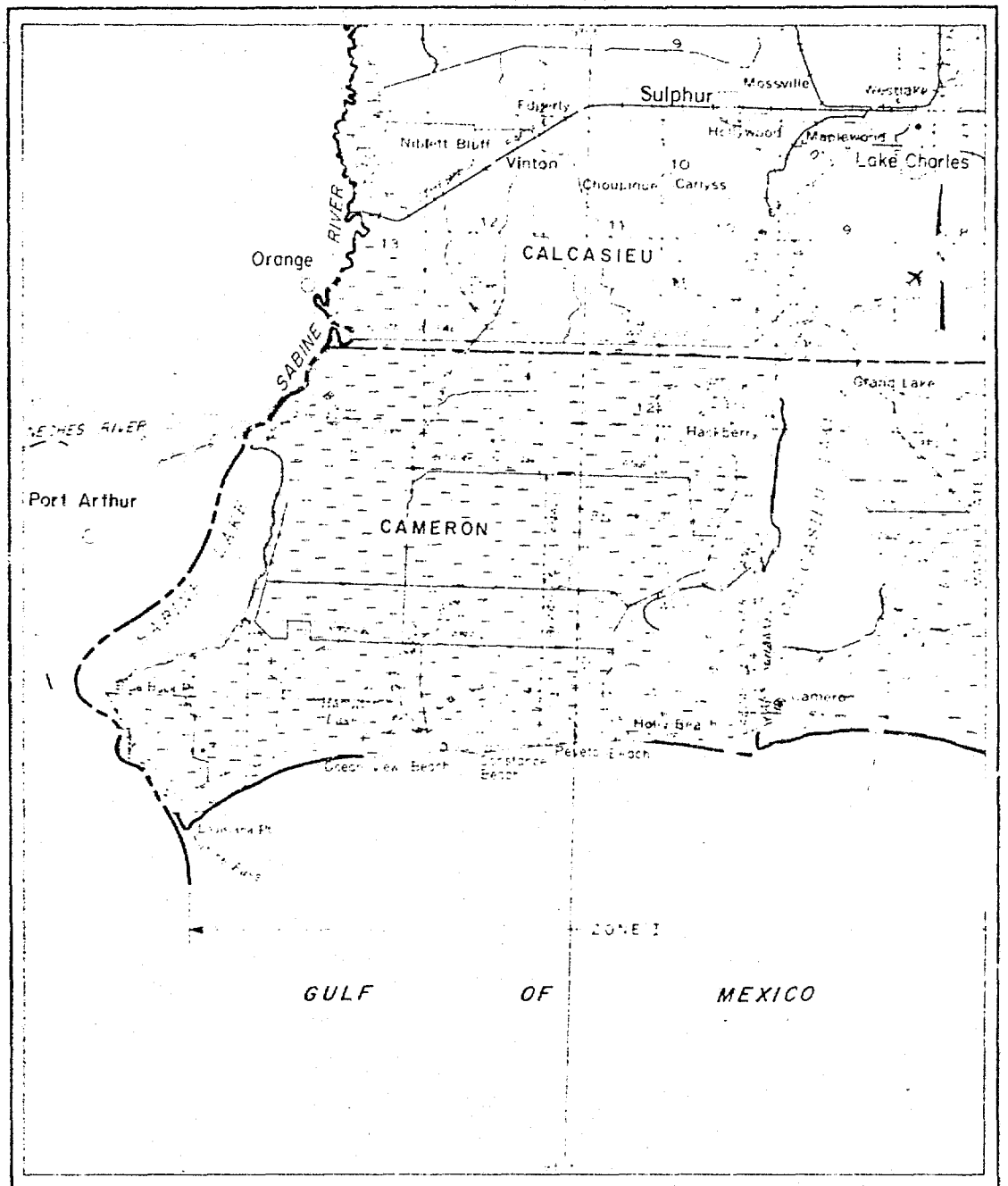
SCALE OF MILES

5 0 5 10

JULY 1971

FILE NO H-2-25404

PLATE 108



LEGEND

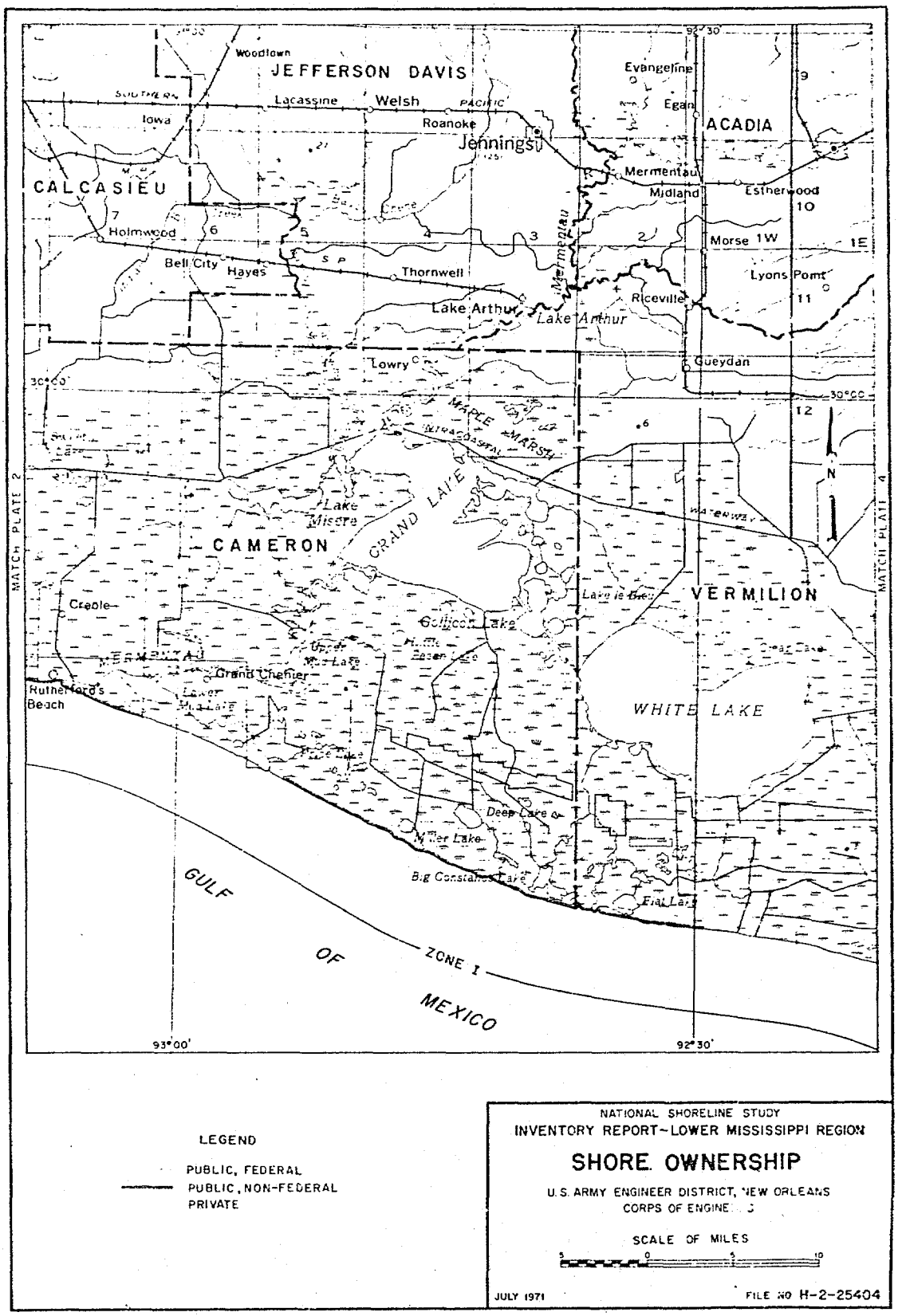
PUBLIC, FEDERAL
PUBLIC, NON FEDERAL
PRIVATE

INVENTORY REPORT - LOWER MISSISSIPPI REGION

SHORE OWNERSHIP

R-2-25404

PLATE 2C



LEGEND

PUBLIC, FEDERAL

PUBLIC, NON-FEDERAL

PRIVATE

NATIONAL SHORELINE STUDY

INVENTORY REPORT-LOWER MISSISSIPPI REGION

SHORE OWNERSHIP

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

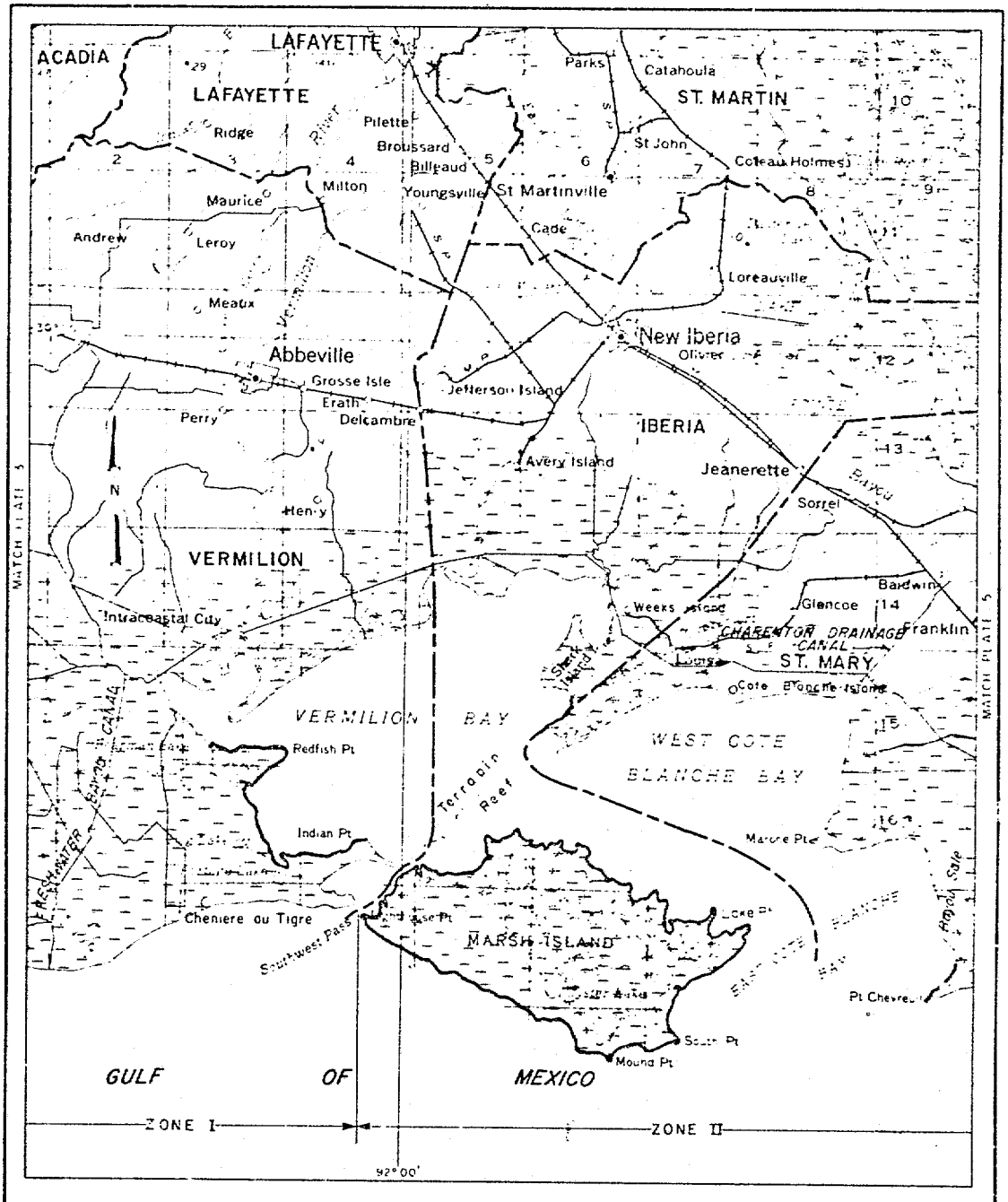
SCALE OF MILES

5 0 5 10

JULY 1971

FILE NO H-2-25404

PLATE 30



LEGEND

PUBLIC, FEDERAL
PUBLIC, NON-FEDERAL
PRIVATE

NATIONAL SHORELINE STUDY
INVENTORY REPORT - LOWER MISSISSIPPI REGION

SHORE OWNERSHIP

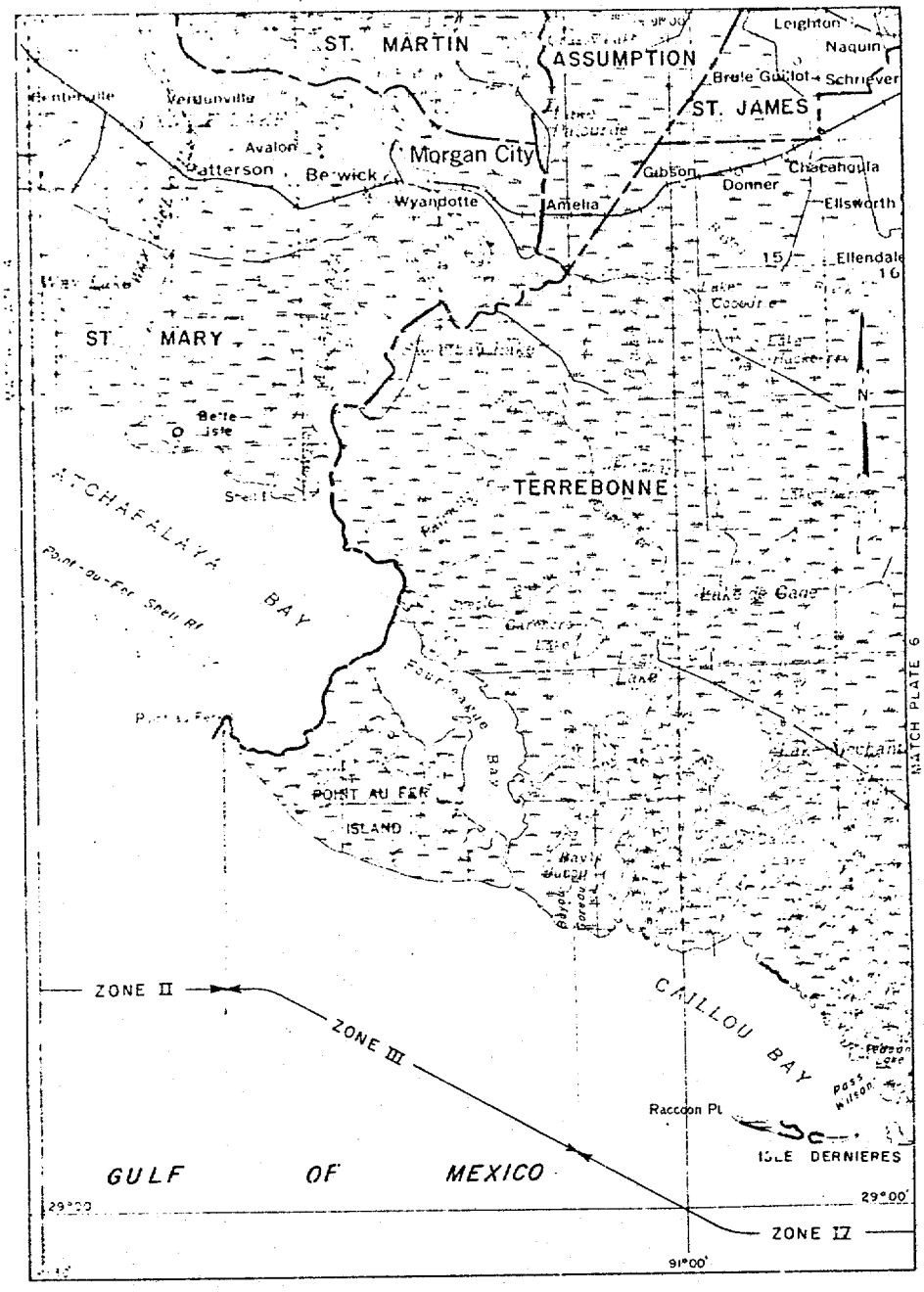
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SCALE OF MILES

JULY 1971

FILE NO. H-2-25404

PLATE 4C



LEGEND

PUBLIC, FEDERAL

PUBLIC, NON-FEDERAL

PRIVATE

NATIONAL SHORELINE STUDY

INVENTORY REPORT–LOWER MISSISSIPPI REGION

SHORE OWNERSHIP

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

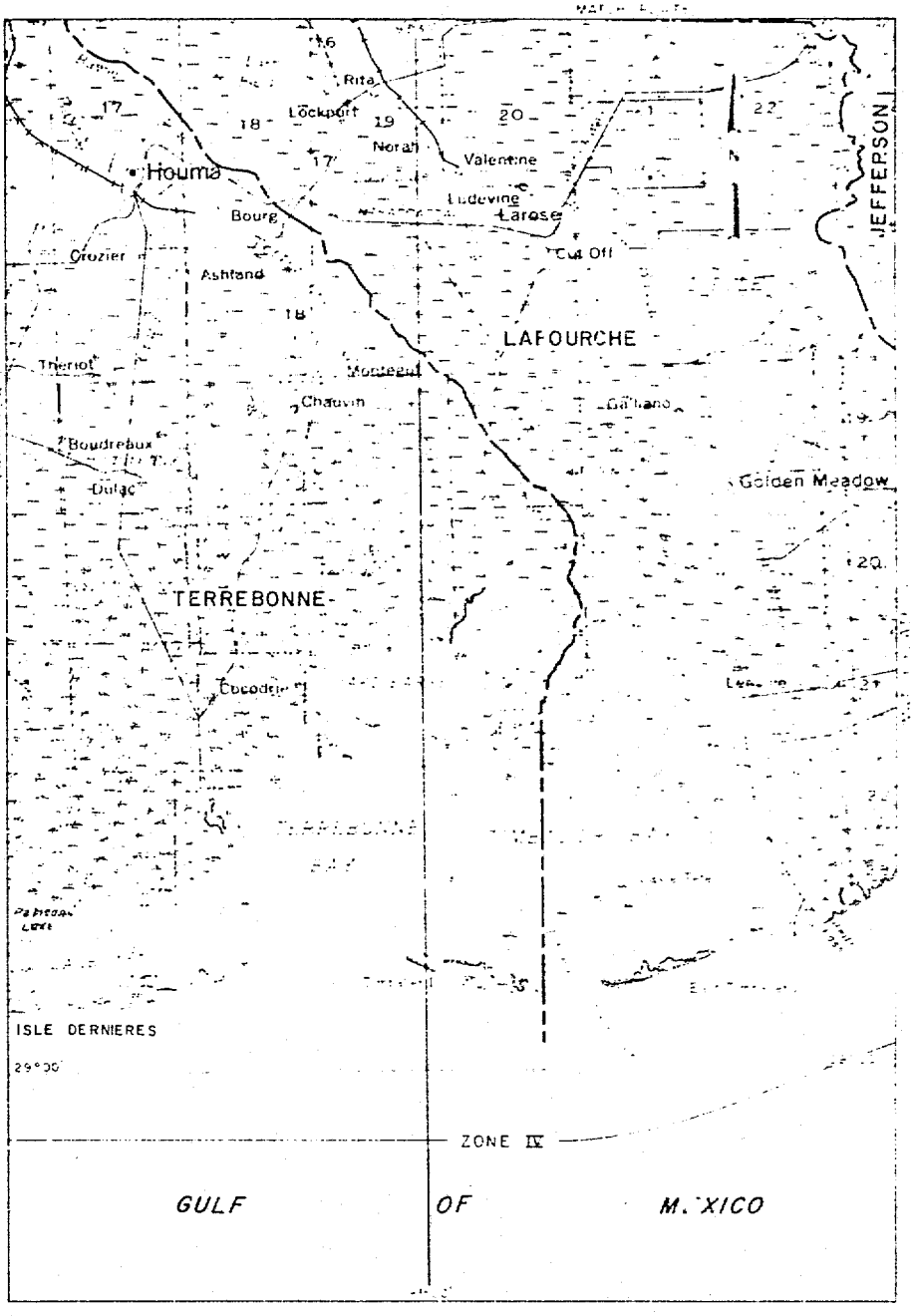
SCALE OF MILES

0 5 10

JULY 1971

FILE NO H-2-25404

PLATE 5C



LEGEND

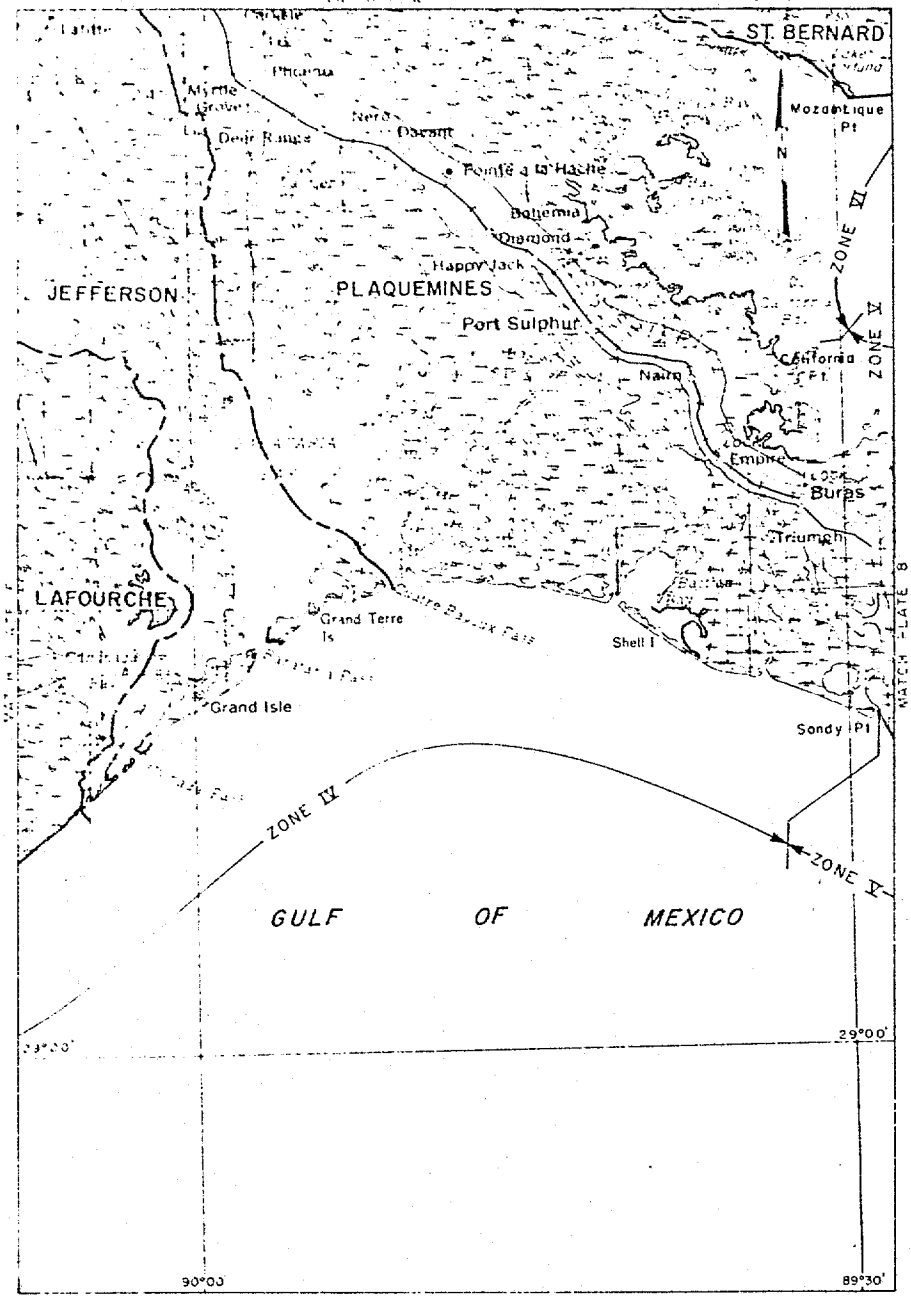
PUBLIC, FEDERAL
PUBLIC, NON-FEDERAL
PRIVATE

INVENTORY REPORT-LOWER MISSISSIPPI REGION

SHORE OWNERSHIP

H-2-25404

PLATE 60



LEGEND

PUBLIC, FEDERAL

PUBLIC, NON-FEDERAL

PRIVATE

NATIONAL SHORELINE STUDY

INVENTORY REPORT–LOWER MISSISSIPPI REGION

SHORE OWNERSHIP

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SCALE OF MILES

0 5 10

JULY 1971

FILE NO H-2-25404

PLATE 7C

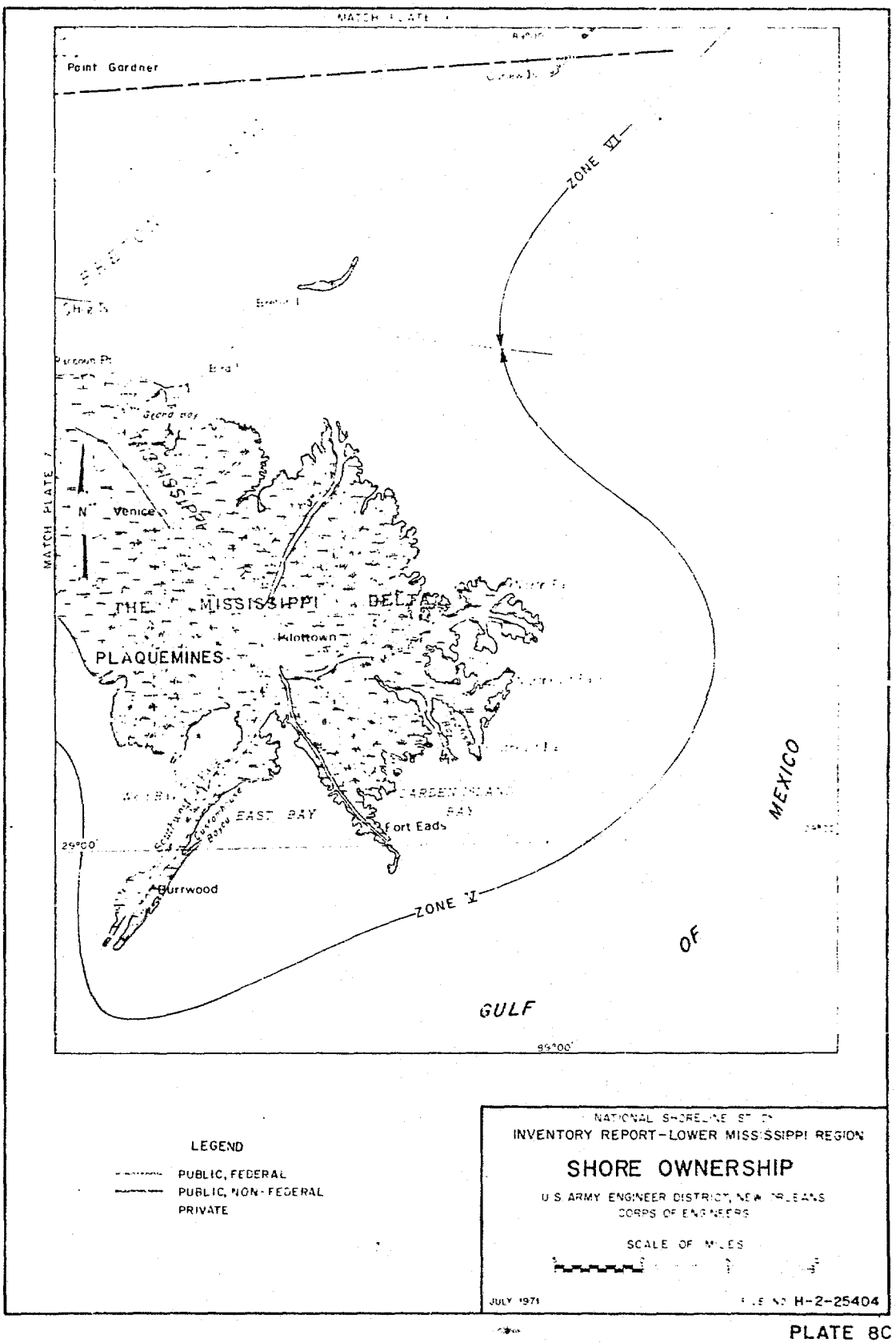
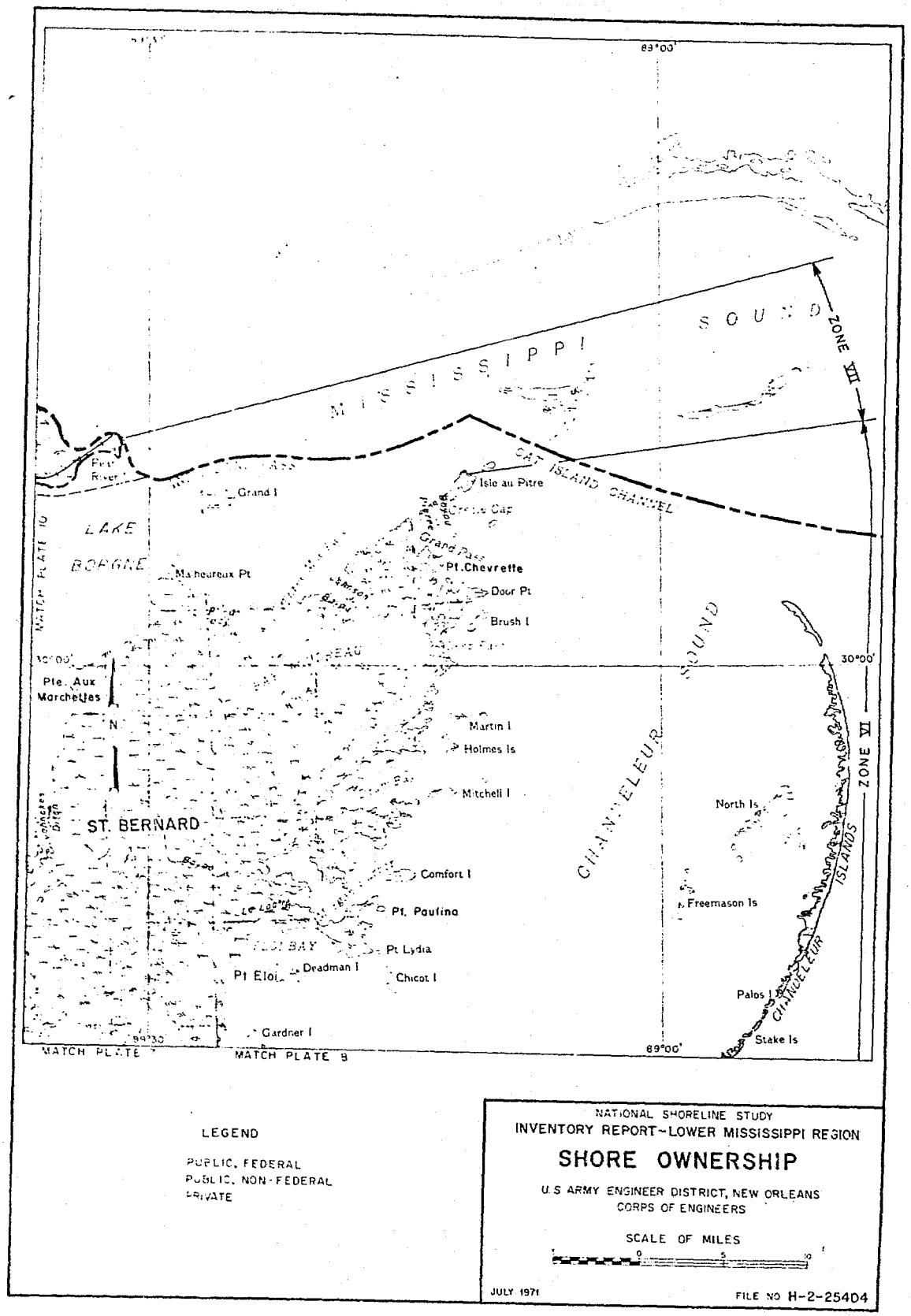

MATCH PLATE 1
Point Gardner
ZONE VI
Venice
THE MISSISSIPPI DELTA
PLAQUEMINES
Hilltown
EAST BAY
Fort Eads
Burrwood
ZONE V
GULF
OF
MEXICO
29°00'
89°00'
LEGEND
PUBLIC, FEDERAL
PUBLIC, NON-FEDERAL
PRIVATE
NATIONAL SHORELINE STUDY
INVENTORY REPORT-LOWER MISSISSIPPI REGION
SHORE OWNERSHIP
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
SCALE OF MILES
JULY 1971
FILE NO H-2-25404

PLATE 8C



LEGEND

PUBLIC, FEDERAL
PUBLIC, NON-FEDERAL
PRIVATE

NATIONAL SHORELINE STUDY
INVENTORY REPORT-LOWER MISSISSIPPI REGION

SHORE OWNERSHIP

U.S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SCALE OF MILES

JULY 1971

FILE NO H-2-25404

PLATE 9C

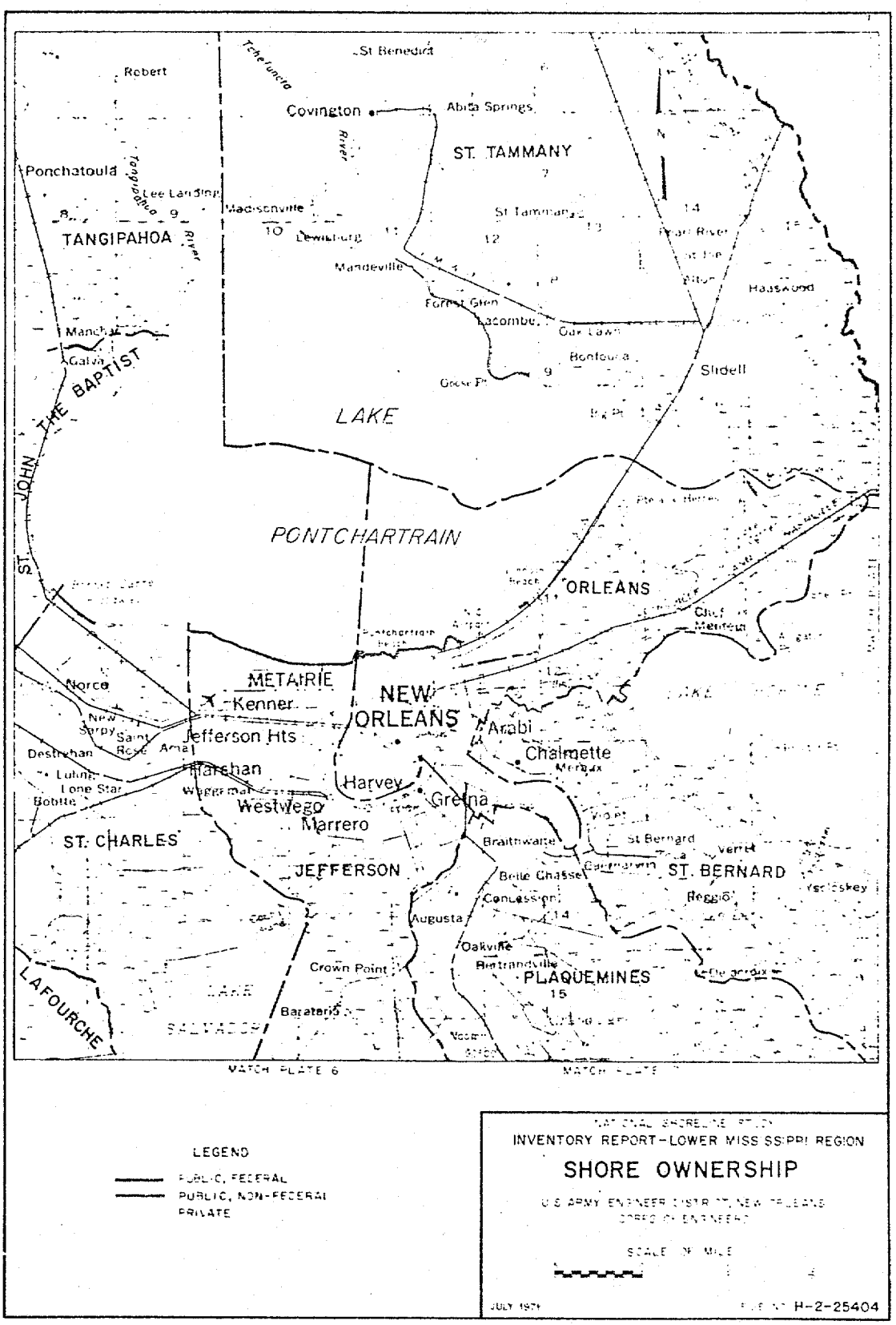

St Benedict
Robert
Tchefuncta River
Covington
Abita Springs
ST. TAMMANY
Ponchatoula
Tangipahoa River
Lee Landing
Madisonville
TANGIPAHOA
Lewisburg
Mandeville
Forest Glen
Lacombe
Oak Lawn
Bonfouca
Slidell
Pearl River
Hickwood
Manchac
Galva
ST. JOHN THE BAPTIST
LAKE
PONTCHARTRAIN
ORLEANS
Norco
METAIRIE
Kenner
NEW ORLEANS
Arabi
Chalmette
Jefferson Hts
Destrehan
Luling
Lone Star
Bobtte
Harahan
Harvey
Gretna
Westwego
Marrero
ST. CHARLES
JEFFERSON
Braithwaite
St Bernard
Verret
Belle Chasse
ST. BERNARD
Reggio
Augusta
Oakville
Crown Point
Bertrandville
PLAQUEMINES
LAFOURCHE
Barataria
MATCH PLATE 6
LEGEND
PUBLIC, FEDERAL
PUBLIC, NON-FEDERAL
PRIVATE
INVENTORY REPORT-LOWER MISSISSIPPI REGION
SHORE OWNERSHIP
JULY 1974
H-2-25404

PLATE 10C

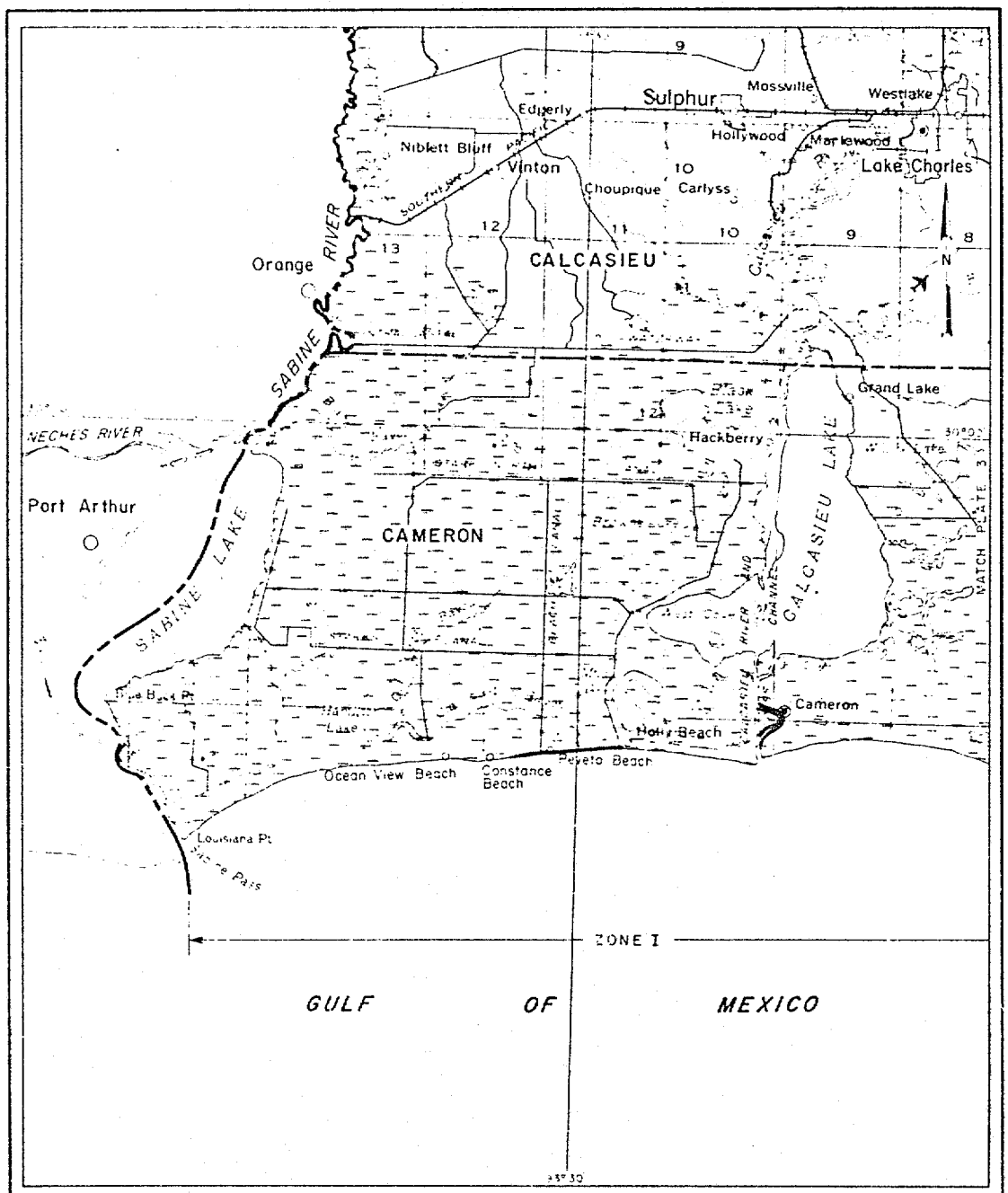

Sulphur
Mossville
Westlake
Edgerly
Hollywood
Markewood
Niblett Bluff
Vinton
Choupique
Carlyss
Lake Charles
Orange
SABINE RIVER
CALCASIEU
Grand Lake
NECHES RIVER
Hackberry
Port Arthur
CAMERON
SABINE LAKE
CALCASIEU LAKE
Cameron
Holly Beach
Ocean View Beach
Constance Beach
Peveto Beach
Louisiana Pt
ZONE I
GULF OF MEXICO
LEGEND
RECREATION, PUBLIC
RECREATION, PRIVATE
NON-RECREATION
UNDEVELOPED
NATIONAL SHORELINE STUDY
INVENTORY REPORT - LOWER MISSISSIPPI REGION
SHORE USE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
SCALE OF MILES
JULY 1971
FILE NO. H-2-25404

PLATE 2D

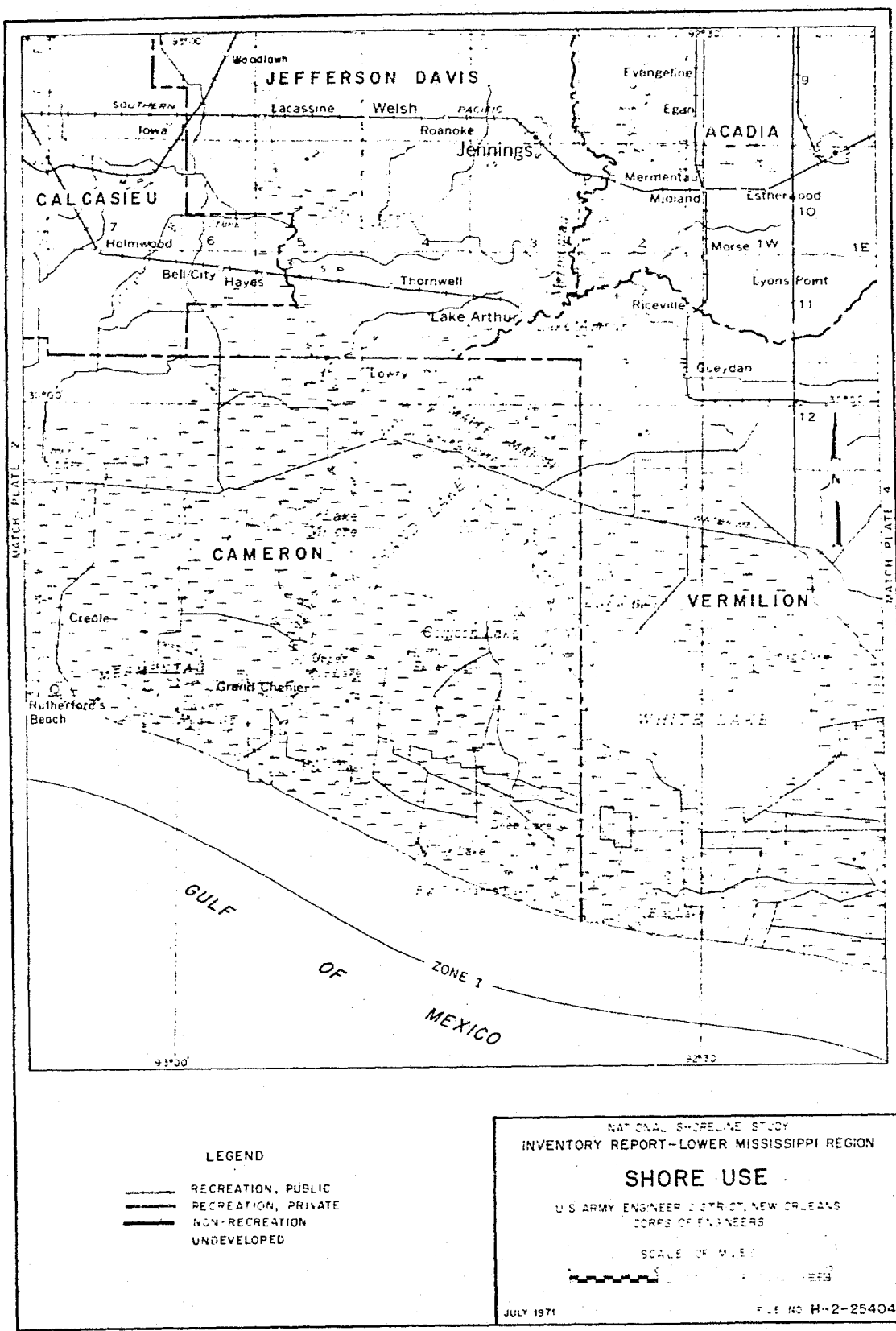
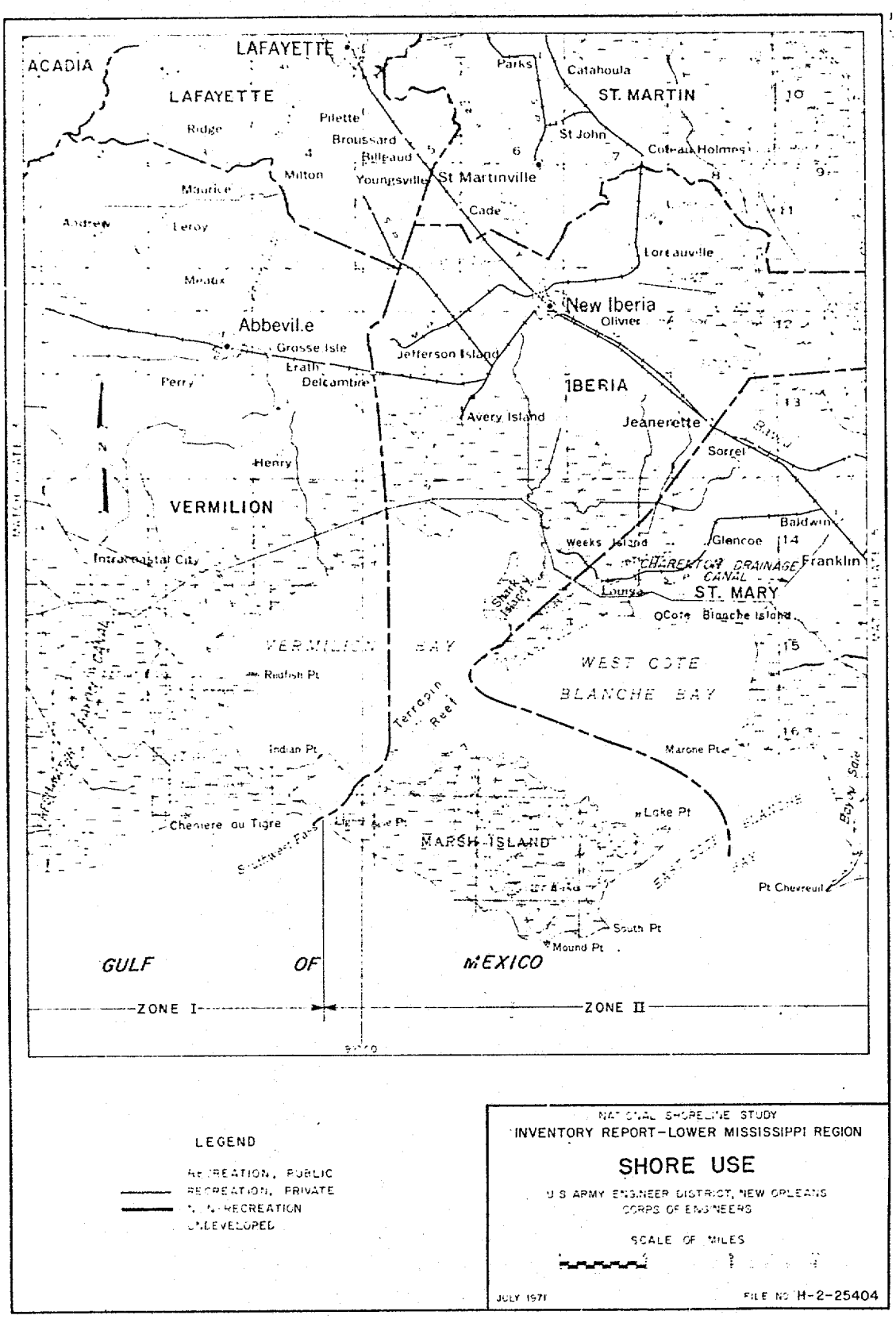

JEFFERSON DAVIS
Woodlawn
Lacassine
Welsh
Roanoke
Jennings
Evangeline
Egan
ACADIA
Mermentau
Midland
Estherwood
CALCASIEU
Holmwood
Bell City
Hayes
Thornwell
Lake Arthur
Morse
Riceville
Lyons Point
Gueydan
Lowry
CAMERON
VERMILION
Creole
Grand Chenier
Rutherford's Beach
WHITE LAKE
GULF OF MEXICO
ZONE 1
MATCH PLATE 2
MATCH PLATE 4
LEGEND
RECREATION, PUBLIC
RECREATION, PRIVATE
NON-RECREATION
UNDEVELOPED
NATIONAL SHORELINE STUDY
INVENTORY REPORT-LOWER MISSISSIPPI REGION
SHORE USE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1971
FILE NO. H-2-25404

PLATE 3D



LEGEND

RECREATION, PUBLIC
RECREATION, PRIVATE
NON-RECREATION
UNDEVELOPED

NATIONAL SHORELINE STUDY
INVENTORY REPORT–LOWER MISSISSIPPI REGION

SHORE USE

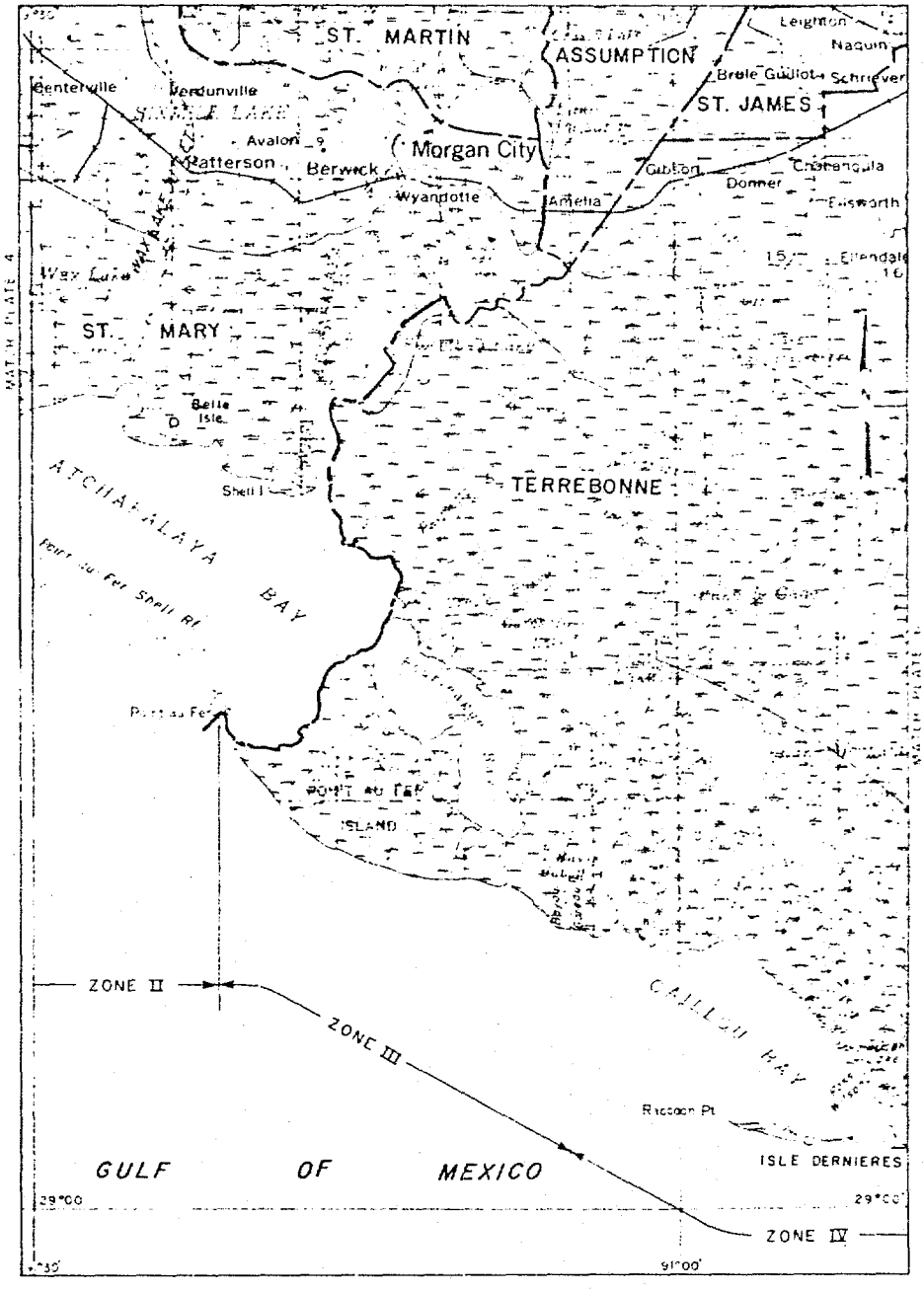
U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SCALE OF MILES

JULY 1971

FILE NO H-2-25404

PLATE 4D



LEGEND

- RECREATION, PUBLIC
- RECREATION, PRIVATE
- NON-RECREATION
- UNDEVELOPED

NATIONAL SHORELINE STUDY
INVENTORY REPORT–LOWER MISSISSIPPI REGION

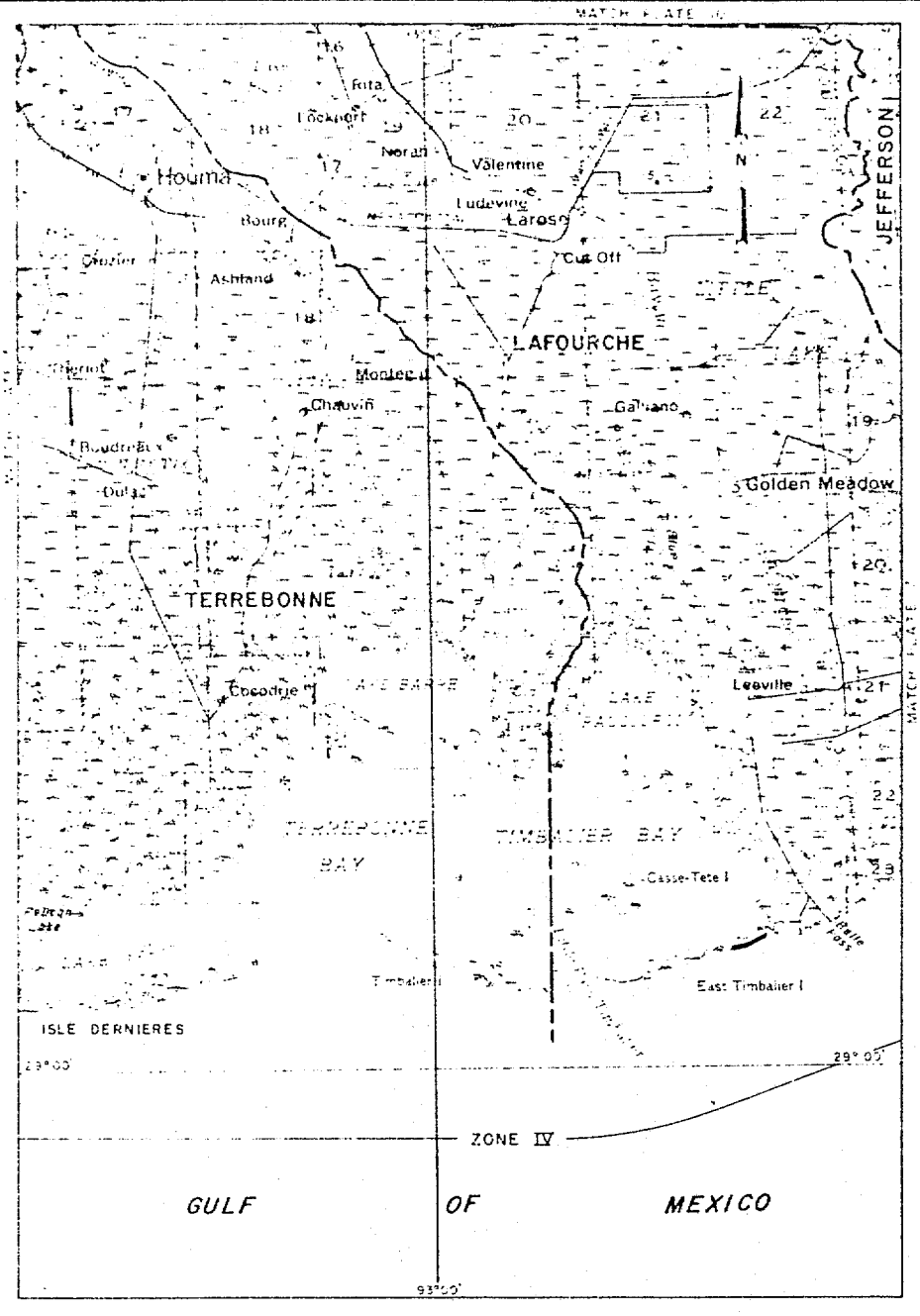
SHORE USE

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SCALE OF MILES

JULY 1971 FILE NO H-2-25404

PLATE 5D



LEGEND

RECREATION, PUBLIC
RECREATION, PRIVATE
NON-RECREATION
UNDEVELOPED

NATIONAL SHORELINE STUDY
INVENTORY REPORT - LOWER MISSISSIPPI REGION

SHORE USE

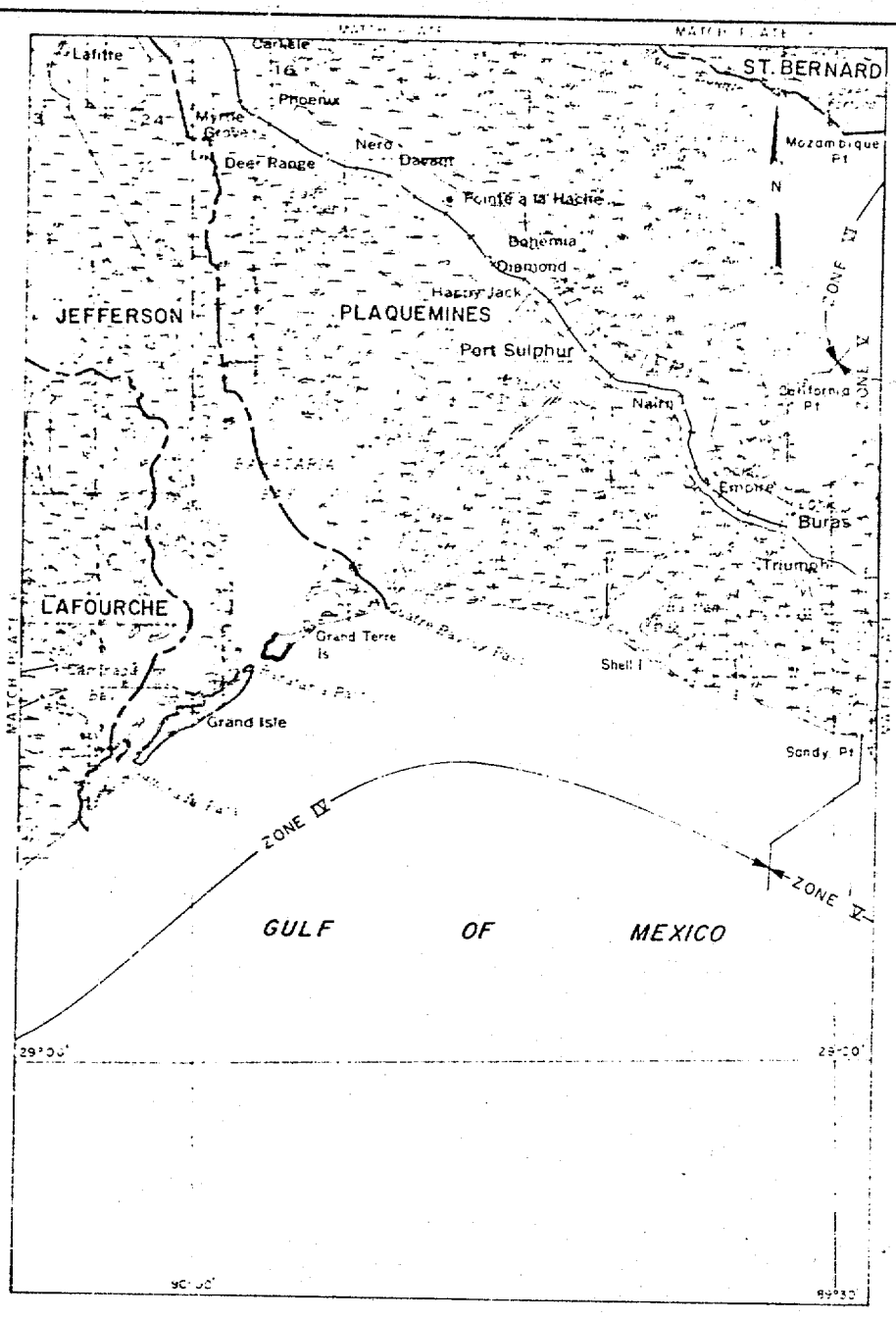
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SCALE OF MILES

JULY 1971

FILE NO. H-2-25404

PLATE 6D



LEGEND

- RECREATION, PUBLIC
- RECREATION, PRIVATE
- NON-RECREATION
- UNDEVELOPED

NATIONAL SHORELINE STUDY
INVENTORY REPORT-LOWER MISSISSIPPI REGION

SHORE USE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SCALE OF MILES

JULY 1971

FILE NO. H-2-25404

PLATE 7D

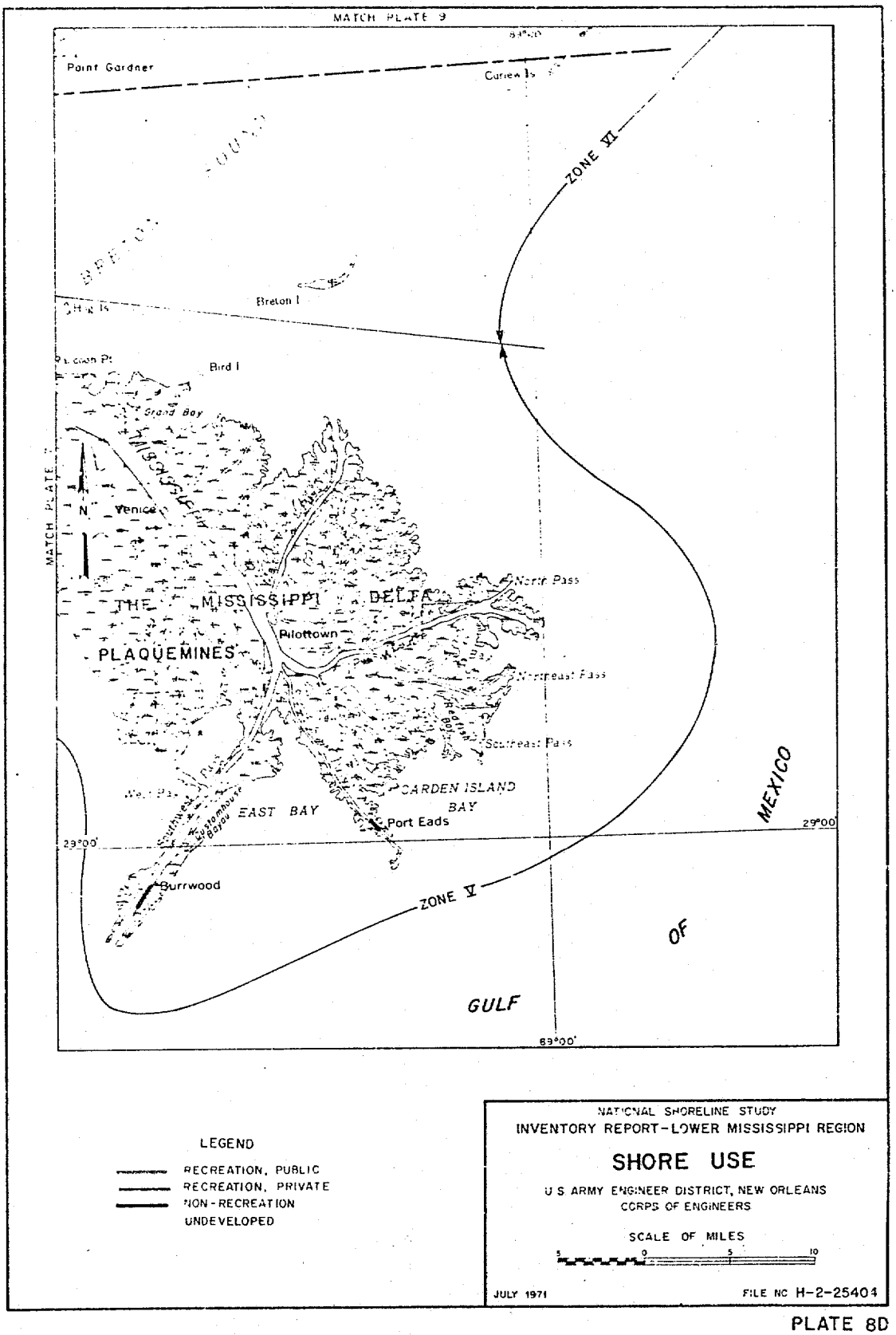

MATCH PLATE 9
Point Gardner
Curlew Is
ZONE VI
Breton I
Bird I
Grand Bay
MATCH PLATE 7
Venice
THE MISSISSIPPI DELTA
PLAQUEMINES
Pilottown
North Pass
Northeast Pass
Southeast Pass
CARDEN ISLAND BAY
EAST BAY
Port Eads
Burrwood
29°00'
ZONE V
MEXICO
OF
GULF
89°00'
LEGEND
RECREATION, PUBLIC
RECREATION, PRIVATE
NON-RECREATION
UNDEVELOPED
NATIONAL SHORELINE STUDY
INVENTORY REPORT-LOWER MISSISSIPPI REGION
SHORE USE
U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
SCALE OF MILES
5 0 5 10
JULY 1971
FILE NO H-2-25404

PLATE 8D

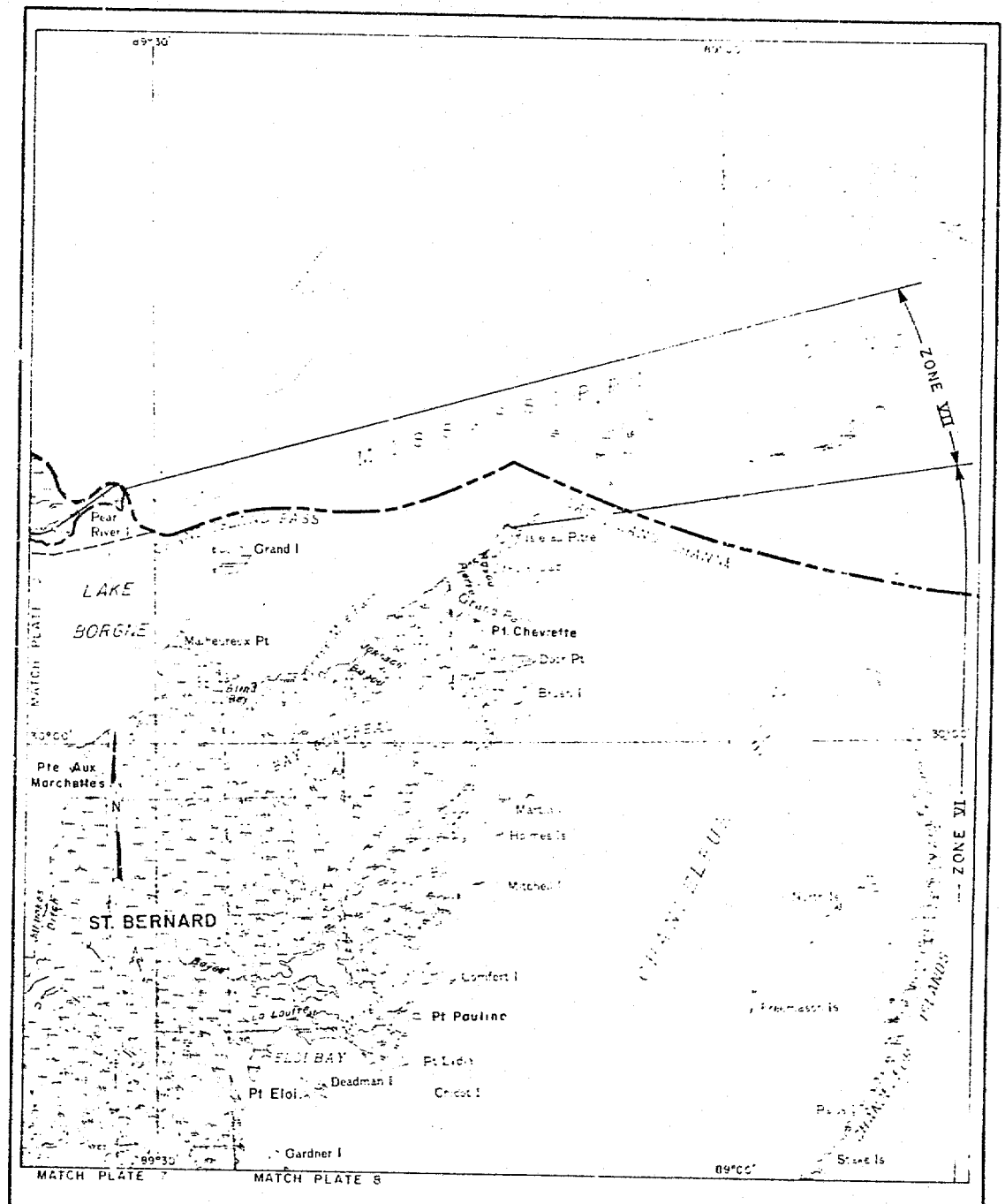

MISSISSIPPI
ZONE XII
ZONE XI
Pear River I
Grand I
LAKE BORGNE
Malheureux Pt
Pt Chevrette
Dixie Pt
Bush I
Pte Aux Marchettes
ST. BERNARD
Comfort I
Pt Pauline
Pt Eloi
Deadman I
Gardner I
Chevt I
Stone Is
MATCH PLATE 7
MATCH PLATE 8
89°30'
89°00'
LEGEND
RECREATION, PUBLIC
RECREATION, PRIVATE
NON-RECREATION
UNDEVELOPED
NATIONAL SHORELINE STUDY
INVENTORY REPORT - LOWER MISSISSIPPI REGION
SHORE USE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
SCALE OF MILES
JULY 19
FILE NO H-2-25404

PLATE 9D

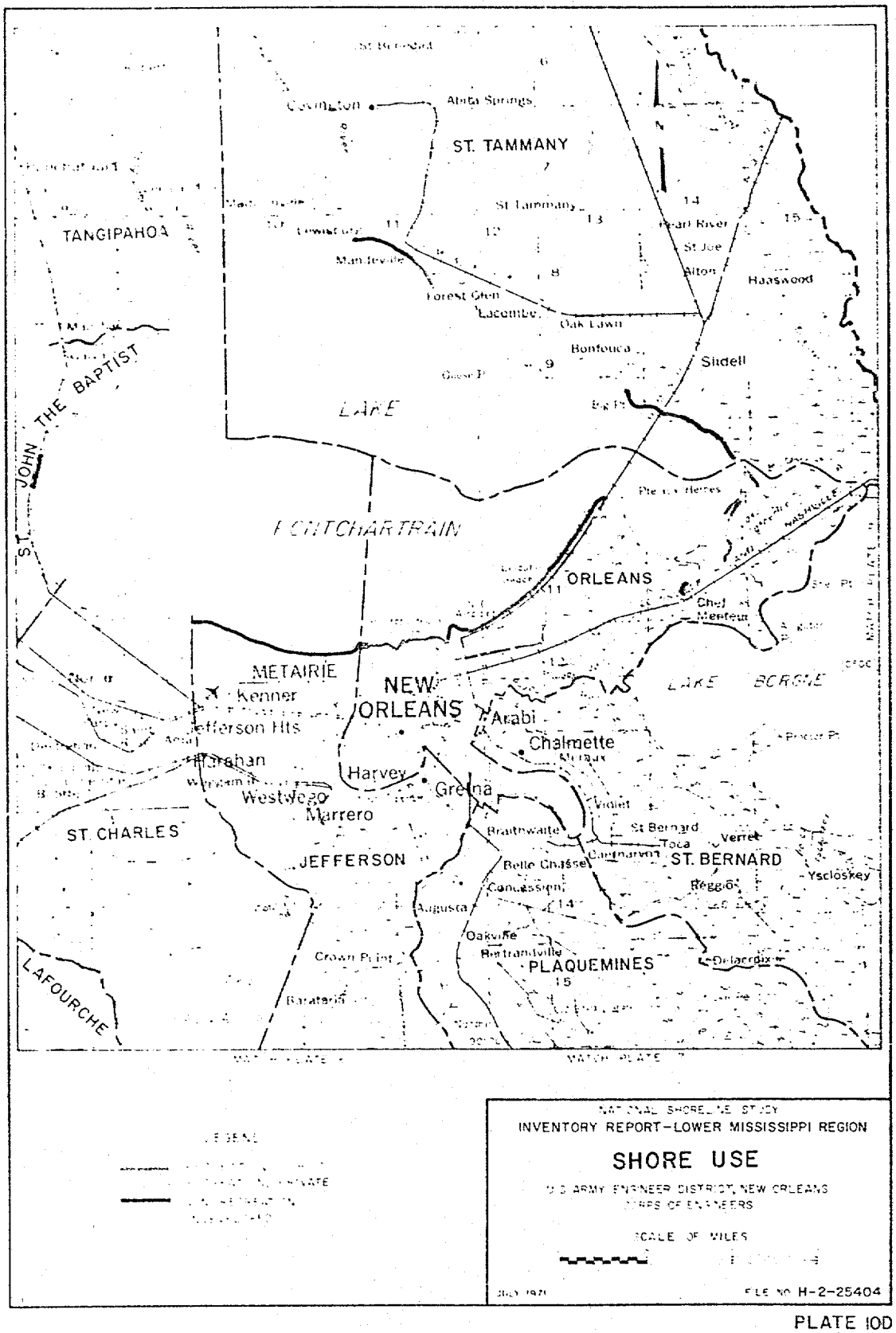

ST. TAMMANY
TANGIPAHOA
ST. JOHN THE BAPTIST
LAKE
PONTCHARTRAIN
ORLEANS
METAIRIE
Kenner
NEW ORLEANS
LAKE BORGNE
Jefferson Hts
Harahan
Westwego
Harvey
Marrero
Gretna
Arabi
Chalmette
ST. CHARLES
JEFFERSON
ST. BERNARD
PLAQUEMINES
LAFOURCHE
Slidell
Bonfouca
Lacombe
Oak Lawn
Forest Glen
Mandeville
Covington
Abita Springs
Pearl River
St Joe
Alton
Haasswood
Chef Menteur
Braithwaite
Violet
St Bernard
Verret
Toca
Caernarvon
Reggio
Yscloskey
Bellechasse
Concession
Augusta
Oakville
Bertrandville
Delacroix
Crown Point
Barataria
NATIONAL SHORELINE STUDY
INVENTORY REPORT-LOWER MISSISSIPPI REGION
SHORE USE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
SCALE OF MILES
FILE NO H-2-25404

PLATE 10D

END

DATE

FILMED

9-20-71